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A Medicine-man's Implements and Plants in a Tiahuanacoid Tomb in Highland Bolivia

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BY

S. HENRY WASSÉN

CONTRIBUTORS

Wolmar E. Bondeson, Helge Hjalmarsson, Carl-Herman Hjortsjö,
Bo Holmstedt, Eskil Hultin, Jan-Erik Lindgren, Thomas Liljemark,
and Richard Evans Schultes

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S. Henry Wassén
Director of the Museum

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ELANDERS BOKTRYCKERI AKTIEBOLAG

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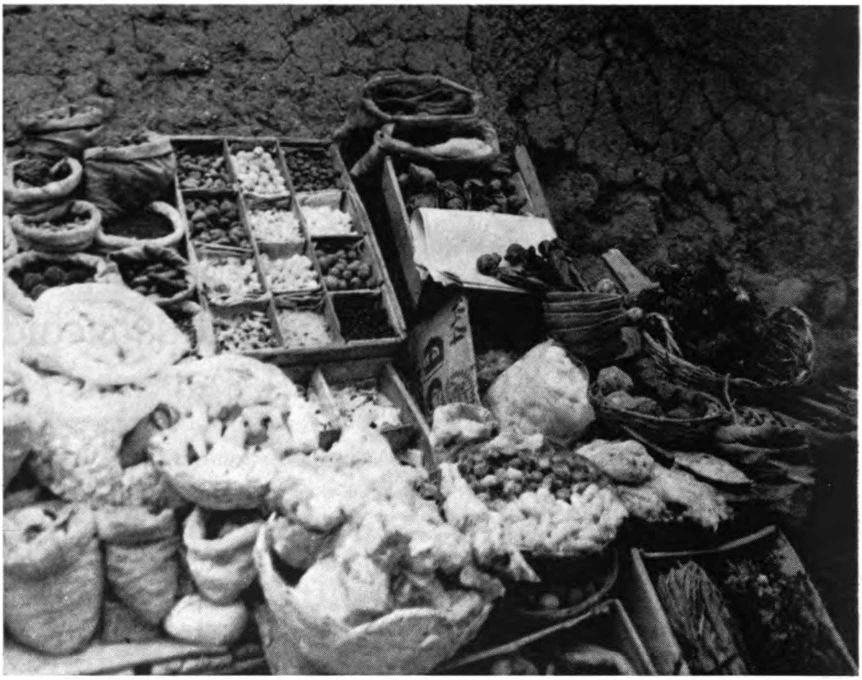
GÖTEBORG

1972



One of many greengrocery and medicine shops of female street-hawkers (or chifles*) in Calle Linares, La Paz. Photograph: S. Henry Wassén, August 17, 1970.*

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CONTENTS

S. Henry Wassén, A medicine-man's implements and plants in a Tiahuanacoid tomb in Highland Bolivia (with 60 figures and 3 colour plates) 8–114

Richard Evans Schultes, Ilex Guayusa from 500 A.D. to the present (with 8 figures) 115–138

Bo Holmstedt and Jan-Erik Lindgren, Alkaloid analyses of botanical material more than a thousand years old (with 2 figures) 139–144

Carl-Herman Hjortsjö, Anthropological investigation of an artificially deformed and trepanned cranium from Niño Korin, La Paz, Bolivia (with 6 figures) 145–158

Helge Hjalmarsson and Thomas Liljemark, Textile fibres in archaeological material from a Tiahuanacoid tomb in Bolivia (with 19 figures) 159–170

Helge Hjalmarsson, Report on examinations of seven yarn samples from a Bolivian archaeological collection (with 9 figures) 171–176

Wolmar E. Bondeson, Tobacco from a Tiahuanacoid Culture Period (with 1 figure) 177–184

Eskil Hultin, The accuracy of the radiocarbon dating (with 1 figure) 185–196

A MEDICINE-MAN'S IMPLEMENTS AND PLANTS IN A TIAHUANACOID TOMB IN HIGHLAND BOLIVIA

S. Henry Wassén

Gothenburg Ethnographic Museum, Gothenburg, Sweden

Page

Acknowledgements 8

Introduction and General Discussion 11

1. Niño Korin 11
2. The Finding Circumstances 13
3. The Callahuayas 15
4. Guayusa, Enema Syringes, Snuff Trays, and Vilca 18
5. Broken Arrows 24
6. A Bola Weapon 25
7. A Human Skull and a Tuft of Hair 26
8. Other Objects 27
9. Radiocarbon Measurements 28

Description and Comparative Notes 31

Category A. Five Snuff Trays of Wood and a Tube 31
Category B. Bamboo Tubes used as Containers 40
Category C. Containers made of Fruits 41
Category D. Fur and Skin Pouches 42
Category E. Reeds and Putative Enema Syringes 43
Category F. Spatulas of Wood and a Wooden Probe? 44
Category G. Mortar and Pestles, Wooden Parrot Stick 46
Category H. Weapons 47
Category I. A Tupu or Shawl-Pin 48
Category J. A Human Skull and a Tuft of Hair 49
Category K. Baskets 49
Category L. Textiles 53
Category M. Leaves 61

Figures 62–108

Bibliography 109

Colour Plates I, II, and III are placed between pages 48–49

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Göteborg, April 1972

S. Henry Wassén

Göteborgs Etnografiska Museum

INTRODUCTION AND GENERAL DISCUSSION

1. *Niño Korin*

During a short visit to La Paz, Bolivia, in August 1970, following my participation in the 39th International Congress of Americanists at Lima, Peru, I had the opportunity to observe a small but interesting collection in the Bolivian National Archaeological Museum. The objects attracted my interest because of my studies of paraphernalia used for taking hallucinogenic snuffs by the South American Indians, now and in pre-Columbian times. It was a small collection from "Niño Korin, Villa General Pérez (Charasani), Prov. Saavedra", in the Department of La Paz.

This collection consisted of some wooden snuff trays (labelled, "tabletas de madera"), a small round wooden mortar ("mortero"), pestles to the mortar ("manos de mortero"), a small spoon of bone ("cucharilla de hueso"), a fragmentary tube for nasal inhalation ("fragmento de tubo para absorver por via nasal"), a small gourd considered to have been used as a container for a powder ("porro destinado para deposito de polvos"), and, finally, a plant called *willca* or *willca-willca* ("planta llamada la willca o willca-willca"). This plant did not belong to the original find, as it had been brought from Coroico in the *Yungas* of La Paz (the hot eastern slopes of the Andes). In answer to my specific question, a Bolivian museum colleague explained that the plant now exhibited in the show case was of the same kind as a fragmentary specimen found with the objects in Niño Korin. The botanical name was given as *Piptadenia grata*, an epithet which, however, seems to be uncertain (see Schultes, 1967:293, and von Reis Altschul, 1964, for a taxonomic study of the genus and excluded names).

This was the first time that I heard of Niño Korin, and at that moment I could not imagine that, in the near future, I should have an opportunity to describe and catalogue for the Gothenburg Ethnographic Museum in far away Sweden the archaeological collection (Number *70.19*) from the same Niño Korin presented in this volume. To judge from its contents this collection seems to be a medicine man's specialized equipment. It had been found in June, 1970, at Niño Korin in the geographical habitat of the Callahuayas in the provinces Bautista Saavedra and Muñecas, by my late colleague Stig Rydén (1957:7), described as the "northernmost Bolivian highland provinces on the east slopes of La Cordillera Real east of Lake Titicaca and bordering on Peru".

When back in Sweden, I was able to study the important work *Cultura Callawaya* published by Enrique Oblitas Poblete in 1963, and from what I understand from his caption for plate No. 87 ("Objetos encontrados por el Dr. Edgar Oblitas en una tumba de Callijicho") and the text on page 491, the collection in the National Archaeological Museum at La Paz must have been presented to the museum by Dr. Edgar Oblitas Fernández, a son of Dr. Enrique Oblitas Poblete, who, like his father has a vivid interest in the cultural traditions of their high Andean fatherland.

The name Niño Korin is not used in the work of Oblitas Poblete but it is said on page 491 that in a place called Qalli-ichu (also written Calli-icho and Callijicho) and Jiriachi, Dr. Edgar Oblitas found some very interesting specimens which had been abandoned by two excavating *Niñoqorin* Indians. These specimens, some evidently of the same general character as single objects in the collection 70.19., had been presented by Dr. Edgar Oblitas to the *Museo Tiaguanacu* of the city of La Paz. An article on this collection in the Archaeological National Museum had been published by Gregorio Cordero Miranda, at that time Director of the Museum, in the newspaper "La Nación", and, as the newspaper article has been quoted on pages 491–493 in the work referred to here (Oblitas Poblete, 1963), it is easy to identify one by one the pieces in the museum label said to have come from Niño Korin as exactly those which in the book are said to have been found in a grave at Callijicho. The newspaper information on the objects is, however, much more detailed than the short texts in the show-case and will be referred to in the general description of the collection from Niño Korin in this volume (fig. 1).

Among the Niño Korin objects given to the museum in La Paz by Dr. Edgar Oblitas is also at least one transverse bamboo flute (*pincollo*) with interesting pyrographic ornaments described by Oblitas Poblete (1963:493, and fig. 90).

My efforts to find Niño Korin on a map were not encouraging. Following Ballivian (1890:80), I first knew only that it should be looked for near Charasani (or Charazani), recently changed to Villa Gral. José Pérez (Ponce Sanginés, 1969:148) which according to the U.S. Board on Geographic Names, Gazetter No. 4, Bolivia, lies at S 15° 12′ W 69° 03′. Oblitas Poblete (1963: 486–491) who mentions the main plaza of Charazani as a "chullperío notable" (a *chullperío* from the word *chullpa* in its broad meaning of a grave of archaeological character) offers also the interesting information that "algunos chullpas se encuentran enterrados en tinas de barro, otros en cestas de paja, muchos en nichos calados en plena roca", or in English, "some chullpas (here the word means grave finds) are found buried in earthenware jars, others in baskets (or plaited straw protection), and many in niches hewn out of the rock".

Regarding the name I first accepted and will use through this book the form Niño Korin as it was given to me in Bolivia. During my search for the exact location of the place I wrote to a Canadian friend of mine in Bolivia, who asked some Indians and got the meaning of the name as "Golden Child", or "Golden Baby", evidently because of the fact that Niño had been taken as Spanish. Gonzáles de Holguín (1901:181) has, however, *Nina kori* for "*oro fino*", from *nina*, adj. "fino, muy perfecto" and *kori*, "oro", and it is no doubt in these Quichua words that we should look for the meaning of "Niño Korin". Ballivian (1890:80) spells it Niño-corin.

I was later informed that Niño Korin is a native *aldea* or *estancia* of about 200 inhabitants situated in the middle of the slopes of the small mountain (*cerrillo*) Callacallan. The finds were, however, not made exactly in Niño Korin, but in a place (ruin) in front of it called Calliicho, in the Cantón Chullina, Province of Bautista Saavedra, Department of La Paz. Bautista Saavedra was earlier a part of the province of Muñecas, but it is now a province of its own, in size 2.525 kilom.^{2}, with Villa Pérez, earlier Charazani, as capital, and bordering the provinces Caupolicán, Camacho, Muñecas and Larecaja. If marked on the map in fig. 2, taken from Wrigley (1917:185), Calliicho should be placed somewhat northeast of Charazani-General Pérez and southeast of Curva, with Niño Korin east of Calliicho. As the latter name had been substituted in the National Museum of La Paz with Niño Korin, I am going to use this name here, adding that the "zona del cementerio de chullpas" is found close to the Cordillera de Curva.

2. *The Finding Circumstances*

The collection described in this volume appeared first to me as a closed find or hoard, containing the equipment of a medicine man with containers, spatulas, enema syringes, some extraordinary interesting snuff trays and a corresponding tube, bag-like pouches with leaves of *Ilex Guayusa*, and, finally, an artificially deformed and trepanned cranium. As this material had been found in the heartland of the Callahuayas of Bolivia, I liked to look upon the whole collection as such a medicine man's laboratorial and medical outfit. I still think so, although I cannot pretend that it has been a find from a concealed niche as I have been informed that the finds were made in a "tumba multifamiliar". This was described as an open passage in the rock, about 50 m. in length, where bodies have been buried one next to another, and where, separated by stone walls, the *tumbas* appear. Each of these graves or niches has one corpse seated in a crouching position ("cada nicho contiene la momia de un cadaver sentado en cuclillas") with its garments. This textile material consists of a special multicoloured shirt or sleeveless tunic (*uncu*) with designs ("con su vestimenta consistente en un poncho especial que se llama *uncu*, el poncho multicolor con dibujos"), and, on the head a sharp-pointed special woven cap called *chino chchullu* ("en la cabeza un gorro puntiagudo especial que llaman *chino chchullu*"). Montell (1929:204), following Cieza de Leon, mentions the cap, *chuco*, of the Aymara. "From La Paz it is expressively stated that the *chucos* were pointed (Rel.geogr., vol. II, p. 69)." The women are dressed in a *huincha*, fillet or headband with figures, in the way of a crown, and a multicoloured *llijlla*, shoulder mantle, with figures ("las mujeres visten con una huincha o faja con dibujos en la cabeza a manera de corona, una llijlla multicolor con dibujos"). Furthermore, they have from the shoulders a *pollera*, generally black with figures striped in the middle of the garment ("una pollera que desciende de los hombros, generalmente negra con fajas en media prenda donde aparecen dibujos"). The feet have special sandals called *ojota* ("los pies calzados con sandalias especiales que llaman ojota"). A man's corpse carries a *capacho* or bag with medicines and amulets ("El cadaver del hombre lleva una capacho o bolsa con medicamentos y amuletos"). According to an information also crowns (or *huinchas*) of gold (which were used by the *mallcus* or Colla kings) have been found in these grave niches.

The *chullpares* are said to be found all over this region, many of them at the foot of the cliffs which are abundant in the region. The *tumbas* are found above the river Curva, that is to say in the lower region, not on the tops where the majority of the *chullpares* are found. This "lower" region is about 3500 m. above sea level.

That evidently very delicate objects have been kept without disintegrating may be explained by the dry winter, although there is much *camanchaca* or heavy fog in the autumn. In archaeological literature, we often get the impression that for climatic reasons such materials as textiles, basketry, etc. usually do not exist in the Bolivian Highlands. "The climate of all the Andean highland area is not conducive to the presevation of vegetal remains and we have only scant evidence of the plants—either wild or cultivated—that was used" (Towle, 1961:62). Writing on Classic Tiahuanaco, Bennett (1946*b*:117) says that "nothing is known about woodwork, calabashes, basketry, and other of the more perishable materials, although they doubtless existed." In the same article (p. 70) he states that "in contrast to the Coast, preservation is poor in the Highlands. Objects of ceramics, stone, bone, and some metal are preserved but other materials usually disintegrate". We must, however, now take as a fact that finds dating from Tiahuanaco containing well preserved materials of wood, basketry, textiles, leaves, etc. recently, and evidently repeatedly, have been saved in what we now know as the region of the Callahuaylas, or, according to Wrigley (1917:183) and others "the traveling doctors of the Andes". The climate can not have been as good here, east of the Cordillera, as that described by Muños Reyes (1971:13) for the region of Titicaca, where it is characterized by its intense drought, especially in the eight months of the dry season, or 'winter', and where everything keeps better. "There are no destructive insects for the food, and no mildew or mold for clothing" (Muñoz Reyes, p. 13). Whatever the climatic conditions have meant for preservation of the finds from Niño Korin, they could hardly have survived until now if the region had been more accessible. Here we can refer to McCutchen McBride's words (1921:13) about the provinces of Omasuyos and Muñecas: "Isolation and an extremely hard environment account for much of the backwardness of this region. Routes of travels, in ancient as in modern times, have left these provinces far to one side."

3. *The Callahuayas*

The problem of the Callahuayas is interesting. It has been pointed out by La Barre (1948:217), who calls them Collawayus, that the "Aymara medicine is highly specialized, and consequently has a great many different categories of practioners." Deriving the name from *q'ola* 'medicine' and *wayu*, a kind of bolsa (bag or pouch), he finds them "the most famous of all." What is relevant to the find described in this work is that the Callahuayas "come chiefly from Caupolican and Muñecas, provincias of the Departamento de La Paz, and particularly from the villages or cantons of Charazani and Curva, a few leagues east of the continental divide (Cordillera Real) in western Muñecas" (La Barre, 1948:218; cf. Tschopik, 1946: 569). Alvarado (1966:63–64) deals with the *callawayas* and other classes of *curanderos*. When Martín de Múrua in the 16th century wrote about "yndios médicos" who went curing from one village to another and had taken the Spanish terms *liçençiados* and *dotores* as an internal professional title, it could be that he describes an old callahuaya system, though he himself believed this "abominable modo de curar" to be something new. His whole description seems to fit the callahuayas (Múrua, 1962–1964, vol. II:101–102).

Ponce Sanginés (1969*a*:147–148) has discussed the fact that Guamán Poma de Ayala is one of the Colonial writers who mentions their names, as litter bearers of the reigning Inca (Guamán Poma 1936:331; cf. Rowe, 1946:239). They were considered as slow litter bearers, "*lleuan alynga los yn°s callauaya—espacio apasearse*" (Guamán Poma, p. 331). Guamán Poma was, however, not the *only one* to mention the Callahuayas and their special reputation as litter bearers. Francisco de Avila, who during the first decade of the 17th century tried to find out all about what he considered as false and superstitious ideas prevalent among the Indians in the province of Huarochiri, has also referred to them. "Unos hombres que se llamaban "Callahuaya" eran los más escogidos del Inca y únicamente a él le servían. Estos hombres vencían en pocos días distancias que requerían mucho más días para el caminar de otras gentes" (Avila, in Arguedas' translation, 1966:133), or, in the edition of Trimborn and Kelm (1967:129): "Dann wurden sehr starke Leute namens Callahuaya vom Inka ausgewählt, die auch einen Weg von vielen Tagen in wenigen Tagen zurückzulegen pflegten."

Ponce Sanginés (1969:148) raises the question: did the chroniclers just forget to mention the Callahuayas, or, did the Callahuayas get their reputation as *curanderos* after the conquest? He considers the solution of this problem to rest in further investigation in which an immigration of natives from the Puna must be taken into account, as evidently groups of Indians emigrated to more tranquil places because of forced work in the mines. To Lastres (1951:117) it seems clear that the importance of the Callahuayas was reduced during the Colonial period, and that they now, also with a diminished social influence, have their settlements in the villages Charazani and Curva in the Department of La Paz. As this view is of importance for our discussion I quote the original: " Cuales son los curanderos actuales, herederos de mucho del arte del "hombre de las medicinas"? Son los *Callahuayas*, que venden sus hierbas en los *Hampi-catu* o mercados ambulantes. Habitan en el sur del Perú y en Bolivia. El *yatiri* y el *Kamili*, son igualmente conocedores del secreto de las hierbas, o brujos. Paredes dice de los *Callahuayas*, que formaban una casta aparte entre los *Kollanas*. Recorren los pueblos de la sierra, llevando en sus alforjas, un arsenal de remidios, amuletos, *cconopas*, *ekekos*, lagartos, etc. Su prestigio disminuyó considerablemente en la Colonia, presentándose en los *Hampi Catu*. En la actualidad, ya menoscabada su influencia social, habitan en los pueblos de Charazani y Curva en el Departamento de La Paz (Bolivia)".

Ponce Sanginés (1969:150) further discusses the controversial explanations of the name for this Indian group of travelling herbalists and vendors. "Al parecer la explicación más satisfactoria radicaría en que deriva de la región septentrional del actual departamento de Puno (Perú), donde aún se conserva el nombre de Carabaya para designar a una provincia, nombre que por extensión se habría aplicado al territorio de la actual provincia boliviana de Bautista Saavedra. En la información levantada por Francisco de Cáceres se estipula en julio de 1573 que los yacimientos auríferos de Carabaya que se explotaban durante el Inkario eran entre otros San Juan del Oro e Hipara, vale decir que se incluía a la prov. de Sandia, que limita por el E. con territorio boliviano. En un otro documento del siglo XVI, se menciona a la provincia de Chacane (o Charasani), compuesta por Pelechuco, Mocomoco, Chuma, etc. "los cuales pueblos son la cordillera adentro de Carabaya" (Ponce Sanginés, 1969*a*:149–150). With this the Bolivian author absolutely rejects the explanation by Paredes (1963:245), Wrigley and others (*e.g.* Otero, 1951:39, following Camacho, 1941–46) that the name should mean "bearer of drugs", "portadores de remedios".

The secret language of the Callahuayas (Oblitas Poblete, 1963:469, speaks of "el idoma callawaya o machchaj juyai") has been discussed and a wide relationship with the extinct Pukina has been proposed among others by Ponce Sanginés (1969:148). Oblitas Poblete (1963:469–481) favors the idea that the Inca rulers had a language other than Quichua "para hablar entre ellos" and that this language could be the same as the so-called secret language of the Callahuayas. He considers the Callahuayas to have functioned in Inca times, favored by the Inca as their "médicos de cabecera". In this idea he follows Garcilasso de la Vega's information about "grandes herbolarios" etc. (Oblitas Poblete, 1963:470). I thank my friend and colleague Dr. Tom Zuidema for a reference to Cristobal de Molina's (El Cusqeño) work, dated 1574, where we find an expression for the interest in medicinal herbs (p. 13) and especially a clear separation of the highland and lowland cultures in a creation myth about Tiahuanaco (p. 14). In this myth, the differences between the highland and lowland inhabitants is accentuated in words like these "y a las que habían de residir en las montañas que se fuesen a ellas; y a las que en la sierra, cada una a las partes y lugares que habían de residir". Also, the animals were created differently for the two regions, "mandando a cada una que las que habían de ir a las montañas fuesen a ellas, y los demás fuesen por la tierra".

4. *Guayusa, Enema Syringes, Snuff Trays, and Vilca*

If we now—and it seems to me justifiable—accept the owner of the medical equipment found in Niño Korin as a very early type of Callahuaya, a second question presents itself: Is the use of *guayusa* known among the Callahuaya—that is, according to the published reports of plants employed by them for curing or other purposes?

A search in the list of plants used by the Callahuayas, published in *Catálogo*, etc. (1953:5–10) was in vain.

Bravo (1918:167) mentions a booklet called "*Clasificación de las plantas medicinales usadas en la farmacopea callahuaya o sea de los indios curanderos aymaras que el Comité Departamental de La Paz remite a la Exposición Universal de París*" which was printed in La Paz in 1889. It has not been possible for me to find the original of this publication which has two authors, Nicanor Iturralde and Eugenio Guinault. Since, however, Otero (1951:188–192) has published the same list, I have had a chance to examine it. *Ilex Guayusa* was not included in the list of botanical names. Bollaert (1834) has in his list "of most of the articles that compose this travelling shop (of the 'Chiritmanos', by some called the travelling doctors of Peru, and are Indians of Upper Peru, or, as it is now termed, Bolivia", *op.cit.*, p. 32) the Aymara word *youruma*, defined as "bark of a tree, powdered, and taken as snuff in headach". Whether or not this is the same as No. 87 *yuruma* in Otero's list (1951) I do not know, but in this list of 1889, it is botanically identified as *Laurus*, its therapeutic value is given as a resolutive, and it is said to be used for curing *equimosis* and *hemicránea*. Oblitas Pobletas (1969:216) has listed the medicinal use of the bark, leaves and flowers of *Laurus nobilis* Linn., but he does not give its name in Aymara. He has, however, the Aymara *yoroma* (in Quichua, *puño puño*) for *Ilex paraguariensis* (Oblitas Poblete 1969:245), the *maté* or *yerba maté*, and he dedicates half a page of his text to this close relative of *Ilex Guayusa*, which we know as Paraguay tea. As his catalogue "exclusively refers to medicinal plants used by the Callahuayas" (*op. cit.*, p. 17), we must conclude that the plant is known and used by them.

It is uncertain that the stimulant and useful properties of *Ilex para-*

guariensis St. Hil. of the Holly Family, *Aquifoliaceae*, were known in the pre-Columbian Peru, although Harms (1922:180), following Rochebrune (1880:353), has reported finds of leaves of *Erythroxylum Coca* and *Ilex paraguariensis* from a grave at Ancon on the Peruvian coast. Towle (1961:62), however, considers this determination open to doubt. "More probably, the leaves are those of a Peruvian species, several of which may be used satisfactorily for preparing *maté*". According to Cooper (1949:546) "our sources are silent on the early use of *Ilex* beverages among the peoples of the Andean Highlands and west thereof".

Even though I have been unable to find any information on *Ilex Guayusa* Loes. in the literature dealing with the Callahuayas, we are now confronted with the discovery of several portions of leaves from this plant in the collection 70.19., as properly described for the numbers 20 b, 41–47, 52 b, and 58 b. To judge from the finds, the Indian who was buried with his medical equipment took much care in preparing these leaves. They must have been of outstanding importance to this unknown Indian "scientist", who left fine material for radiocarbon dating so many centuries after his activities ceased. The leaves must be considered as a highly important part of the collection, which is also apparent from the contributions of Schultes, Holmstedt and Lindgren in this publication. From my anthropological point of view it seems fascinating that we now through this old find of *Ilex Guayusa* leaves, are able to confirm the use already during Tiahuanaco time of carrying a bunch of such leaves as reported in the 18th century from the Pinche at the Pastaza by missionary Veigl who writes that "wenn sich der Barbar etwann auf einige Tage vom Hause entfernen will, so trägt er auch sein Töpfchen, samt einem Busche Guayussablätter, an dem Halse hangend mit sich" (Veigl, 1785:46). The leaves in the Niño Korin find have been carefully strung together forming flat oval cakes or bundles. The way in which leaves of *Ilex Guayusa* are strung together and sold at the market in Pasto, Colombia, is shown in Dr. Schultes' paper (p. 135). His figure 7 illustrates the Coll. number 71.2.1, which kindly has been presented to the Gothenburg Ethnographic Museum by the American botanist, Mr. Homer V. Pinkley of the Botanical Museum, Harvard University. He bought this bundle of leaves in Pasto in 1966, and, the same year on July 3rd, he bought another bundle of guayusa leaves at Baños, Ecuador, now catalogued in our museum as 71.2.2. In both instances, the use of the leaves was given as "antispasmodic".

The Colombian ethnobotanist, Victor Manuel Patiño, has in his paper of 1965 summarized many of the data on the use and distribution of *Ilex*

Guayusa, which he appropriately called "a neglected stimulant from the eastern Andean foothills". Among the interesting facts that he reports is the observation during the decade 1756–1767 by a missionary, Juan Serra, at the Santa Rosa of the Caquetá Mission that strings with bundles of *guayusa* leaves were hung in the patio to dry (Patiño, 1965:313). He has also referred to the highly interesting Jesuit information published by Velasco (1844:35) that leaves of *huayusa* "are strung together and carried from the low provinces to the highlands" (Patiño, 1965:312), or in the original Spanish text: "*Huayusa*, árbol no muy alto, de hojas largas y anchas como una mano, dentadas sólidas. Estas se conservan ensartadas en hilos, y se llevan de las provincias calientes y bajas á las altas. Dispuestas como el té, de bellísimo gusto, quitan todas las frialdades y las infecciones venéreas. Tambien son el major matricial para las mugeres, á las cuales las fecunda por estériles que sean de muchos años" (Velasco, 1844:35).

Lowie (1948:7) has listed guayusa (*Ilex* sp.) among "Useful wild plants of the Tropical Forests" as "an anesthetizing drug, used in eastern Ecuador". "Guayusa is a purgative and emetic and is believed to give strength" (Steward and Métraux, 1948:626). Steward (1948:529–530) enumerates yoco, coca, and guayusa as "stimulants, taken by anyone, for their effect in anesthetizing or allaying fatigue and hunger" when writing about the tribes of the Montaña. Spruce (1908, vol. 2, pp. 453–454) wrote about guayusa as "a tonic used in the Eastern Andes". In 1857, he found a group of guayusa trees "supposed to date from before the Conquest", "at about 5000 feet above the sea, in the gorge of the Pastasa below Baños, on an ancient site called Antombós". He found that "the Jibaros make the infusion so strong that it becomes positively emetic" (p. 454). Steward (1948:530) says that "guayusa (*Ilex* sp.), anesthetizing and sustaining rather than exhilarating but serving also as an emetic, is used only by the Quijo, Záparo, and Jívaro". Cooper (1949:546) enumerates also the Canelo, Candoshi, Aguano, Panobo, and the 18th-century Pinche, of the Montaña region". He also points out (p. 546) that the guayusa beverage "was earlier drunk through a narrow wooden pipe or a slender reed". A wooden tube as well as reeds are found in the collection from Niño Korin, but I take the tube (70.19.3) to have been used with the snuff trays and at least some of the reeds to have been used as enema syringes.

Karsten (1935:174) states that "the guayusa is not a real narcotic but a tonic, to which the Indians ascribe magical purifying effects". The guayusa tree holds a place in the religion or superstitition of the Jivaro, and this tree and the genipa tree are regarded as "men" (Karsten, 1964:80).

Pérez de Barradas (1957:182) dedicates only a few lines to the guayusa infusion but mentions caffeine as its active principle.

Through Karsten we also have the information that the Jivaro prepare a clyster to purify the stomach of small children. He saw the Indians prepare one of four different plants (which he names) adding that "this strong medicine was injected into the rectum of the child by means of an enema syringe consisting of a hen's (*sic*) bladder attached to a piece of the stem of the sanahoria plant (*Daucus*) which is hollow. Syringes of this kind are commonly used by the Indians" (Karsten, 1935:508–509). Irrespective of the zoologically impossible statement about "a hen's bladder", the notice of the common use of enema syringes among these Indians is of interest as there always is a possibility that the man from Niño Korin directly or indirectly got his stock of guayusa leaves from a northern region.

The importance of the montaña or forest region for the Callahuayas is often stressed. With reference to their journeys, Wrigley (1917:192) says that "the journey is prefaced by a trip to the *montaña* for outfitting the wallets." Bandelier (1910:104) explains the name Chunchos which they sometimes get on the Island by their gathering some of their medicinal herbs "in the *montaña*, or forests, where the wild tribes (often called Chunchos *collectively*) dwell and roam". Paredes (1963:248) says that these curers went to the Camata valleys to get herbs and roots before starting on a long trip. Wrigley (1917:194–195) found that "Camata was one of the gateways into the *montaña*" and he defines four early recognized routes "for the penetration of a vast stretch of *montaña*". With reference to Curva he concludes that "a people situated near the border country with relatively easy access to sources of supply would naturally be selected to act as purveyors of the medicinal plants of the *montaña*. The ancient origin of the profession of the Callahuayas of Curva is at least plausible".

We have here many examples of the use of *Ilex Guayusa*. As to a possible use of guayusa taken nasally or rectally, I refer to professor Schultes' paper in this volume. As far as I know there is no reference to its having been taken as an enema through a straw, which, however, is the case with *Datura*, "drunk or taken as an enema" (Steward and Métraux, 1948:626). In the Niño Korin collection there are, however, some objects (70.19.6,7,12c and 15c) which I take as syringes, complete or fragmentary, but they need of course not be connected with the collection of guayusa leaves in the same collection. "Bulbed enema syringes and straight clyster tubes have been found in numbers in Peruvian tombs" (Ackerknecht, 1949:637). From the

Highland region of Bolivia we have Bollaert's (1834:35) notice that "clysters are recommended in cases of stoppage in the bowels, but of such dirty and useless substances that they need not to be mentioned here", and, above all, Nordenskiöld's find of two enema syringes in a grave in the Ollachea Valley, Peru (border region to Bolivia) during his expedition 1904–1905. These two objects have the catalogue numbers 06.1.489–490 in the Swedish Ethnographic Museum at Stockholm, and they were first mentioned by Nordenskiöld (1906:32). Number 06.1.490 was later published in Nordenskiöld 1930*a*, fig. 21, with the caption "Enema syringe, found in a grave at Ollachea, Peru. The tube is of reed, the bulb of leather, partly reconstruction", and this figure, not being very similar to the original, was used by Heizer (1944:1691) and by Ackerknecht (1949, fig. 188, p. 630). Eric von Rosen (1924:46) translated Nordenskiöld's Swedish text about the two enema syringes as follows: "They each consist of a tube, to which is attached a bladder of thin leather. That I have designated these objects as enema syringes is owing to my having been told by a very reliable Quichua Indian that in his tribe exactly similar syringes always were, and still are, used for the same purpose". We find a translation into Spanish of this passage in Nordenskiöld 1953, p. 75.

By courtesy of the Ethnographic Museum in Stockholm, it has been possible for me to inspect the two Ollachea enema syringes collected by Nordenskiöld. They are shown in fig. 3 and the striking resemblance to the specimens from Niño Korin is immediately noted. The tubes of reed are, however, much shorter in the Ollachea specimens: only 6 cm. The reconstructed illustration by Nordenskiöld (later copied by Heizer and Ackerknecht) gives a somewhat exaggerated picture of the specimen 06.1.490.

Unfortunately, Nordenskiöld did not receive any information from his reliable Indian informant on *what* the Quichua used for the enemas. Could *vilca* or *Anadenanthera colubrina* be involved? I am asking, as we know from Brazilian tribes that the roasted seeds of *paricá* were taken either as a snuff or an enema (see Wassén, 1967:268, tribe listed as 32, Mura). Siri von Reis Altschul (1967) has, with several quotations, convincingly shown that *vilca* is used among the Callahuaylas "as a stimulant and aphrodisiac" (p. 308); she has referred to herbarium specimens labelled *vilca*, one from east of La Paz (p. 308); and she has quoted Nordenskiöld's information (in his paper of 1907, *Recettes magiques*, etc.) that *colubrina* seeds and other items were buried, for magical purposes, under houses in the process of construction (p. 308). Dr. Altschul has also shown that "various forms of the word meant enema or clyster" (p. 311), and, with references to Heizer (1944), Nordenskiöld (1930*b*), and Vélez-López (1930), she continues on page 312: "Archaeological data suggest that the use of enemas was more widespread in pre-conquest times than it was when the Spaniards arrived. What was used in these enemas and in the tubes and tablets of the neighboring regions has not been determined, to my knowledge. *Anadenanthera* seeds have not been found at any Peruvian sites, as far as I know" (*op.cit.*, p. 312). In this context the find of several enema syringes in Niño Korin is of absolute interest as the collection seems to fall within the Tiahuanaco period. The use of these instruments can thus be placed in that period, although the material in the various tubes and containers associated with the find has given no clue as to what remedy was employed.

As a comparative outlook, it is interesting to refer to Zuidema (1964:73), since this author has shown that "the words ayllu and villca are synonymous and both mean lineage, descent, extended family". Zuidema refers to Domingo de Santo Tomás' linguistic works on Peruvian languages from 1560 (republished in 1951). "Santo Tomás gives pump, or purging syringe as an additional meaning of villca. Purging by means of a clyster pipe was known to the South American Indians before the arrival of the Spanish. The sap of a particular tree was used for this purpose and both the tree and the sap itself were called villca (Holguín 1608). According to Poma de Ayala, who called a purging syringe vilcachina, men had purges with the aid of syringes in order to be stronger in battle and in order to increase their health. I would think that the purging syringe and penis were conceived as associated with each other" (Zuidema, 1964:73). To understand this we must know that in Aymara, ayllu means penis (Carpio, 1918:15 and Zuidema, 1964:72). On page 26 of this Introduction I refer to the Quichua word ayllu as meaning the bola weapon.

Another lot in the Niño Korin collection is of outstanding scientific interest. I refer to the five snuff trays of wood (70.19.1,19, 21,23, and 33). They are interesting not only from the iconographic point of view but also for the discussion on the use of psychoactive drugs during the Tiahuanaco period.

When we find no less than five elaborately carved snuff trays, together with a number of containers and a straight tube evidently used for snuff inhaling, we must conclude that these instruments meant very much to the owner. The find presented to the National Museum in La Paz by Dr. Edgar Oblitas contained, as already stated, in addition to some snuff trays and other objects a leaf of *Piptadenia grata* described to have been too fragmentary to be shown but replaced with one of the same botanical identity. If we add this find to other information about the use of this hallucinogenic plant or *Anadenanthera macrocarpa*, that is *Anadenanthera colubrina* var. *Cébil* (cf. Schultes 1967:300), among *e.g.*, the Mataco, Lule and Comechingones (Wassén, 1967:268–270), the credibility for an assumption that the snuff equipment found in June 1970, at Niño Korin has been used with seeds of an *Anadenanthera*, probably *A. colubrina*, seems to be acceptable. We may hope that Niño Korin some day in the near future will offer not only a fragmentary leaf but also seeds well enough preserved to afford a determination. To judge from the finds known to-day, the physical foundation for such a find seems to be within the bounds of possibility.

Regarding the leaf of willca said to be found with the specimens from Niño Korin exhibited in the National Museum at La Paz, it was, according to the most interesting work of Albornoz of the 16th century, customary to bury a body with a vilca plant. I quote the whole description (Albornoz, 1967:22): "Tienen otro género de guacas que llaman vilcas, que aunque la vilca es un género de fruta ponçonosa que nasce y se da en los Andes (*de*) tierra caliente, de hechura de una blanca de cobre de Castilla, cúranse y púrganse con ella *y se entierran con ella en las más provincias deste reino*", . . . (italics by the author). Albornoz mentions also the mortars (*vilcana*) for the grinding of vilca. This word was likewise employed for many other medicines, "en especial de purgas".

5. *Broken Arrows*

The two broken arrow-shafts of *Gynerium sagittatum*, without, and with feathering, are difficult to explain except that they are lowland in technical details (figs. 32-33). Broken bows and arrows are mentioned for death observances among the Bororó (Lowie, 1964:430), but this certainly can not explain the Niño Korin arrows. Furthermore, we do not know much about arrows from Tiahuanaco, where spear thrower and darts were the old weapons (Métraux, 1949*a*: 244–245), although Kidder II (1967:138) assures us that arrowheads were in use at Early Tiahuanaco. According to him, "there are thousands of arrowheads at Tiahuanaco, but hitherto they have been considered to be from the Decadent or later, post-Tiahuanaco periods." According to Bennett (1946*c*:23) "in the pre-Inca periods there is no evidence that the bow and arrow was ever important in this area (Andean Highlands), in spite of the fact that it would seem like a superior weapon for such open country". A guess would be that the Niño Korin arrow shafts were placed there for magical reasons. Karsten (1926: 244–245) has looked upon so-called "grave-offerings" as charms or amulets, the object of which is to protect the remains of the departed against evil spirits. He found many of the objects Nordenskiöld discovered in Aymara and Quichua graves in Bolivia and Peru "significant from the same point of view". "In these graves there were not only numerous fragments of pottery, but also other peculiar articles: a sort of long pin, called *topo* (*tupu*) in the native language, with which the Indian women are still wont to fasten the shawls over their breast, broken stone mortars, human images of wood, feathers, pieces of cows' horns, beads, etc." (Karsten 1926:245). In the Niño Korin find there is a *tupu* (70.19.18). As regards the broken arrows, they might be a parallel to the intentionally broken pottery found in so many graves. When dealing here with the two broken arrows it is interesting to refer to the observation by Bandelier (1904:446) "that the Aymará Indians of the province of Pacajes, on the western slope of the cordillera in northwestern Bolivia, were among the few tribes that, in their primitive condition, used bows and arrows". Whether or not these arrows were of the same type as those found at Niño Korin, I do not know.

6. *A Bola Weapon*

A weapon of particular interest in the collection is the bola, with three leather covered stone balls joined with fiber strings (Coll. No. 70.19.17 a–d). Métraux (1949*a*:253) discussing the occurrence of this weapon (effective in open country) among the South American Indians, writes that "in ancient Peru, bolas were used mainly by the Aymara, but also by the Quichua" and that "bolas have been found in the chullpas of Bolivia". According to Métraux (p. 254) "the most common type of bolas consists of three stones; the one held in the hand is smaller and more elongated than the others. This is the bolas used by the Aymara, the Mojo, and the Chaco Indians, as today by the gauchos of Argentina and Uruguay". In 1536, fighting the Spaniards at Cajamarca (kcaja-marca), the Indians are said to have used "bolas de piedra conectadas en tres ramales de nervios de llama que ellos llamaban *aillus*", these bolas being thrown against the horses of the Spanish troop (Carpio, 1918:15).

Cristóbal de Albornoz refers to "un juego de ayllar que antiguamente jugava el inga" in which *illos* or bolas with "tres ramales de soga hecha de niervos de animales o de cueros dellos, y a los cavos unas pelotas de plomo" were used (Albornoz, 1967:23). Zuidema (1967) has analyzed symbolism in the play of the ayllus and again he points out that the bola weapon, especially that with three bolas, was of phallic and masculine character (Zuidema, 1967:48). In his opus magnum of 1964 (p. 72) he refers to the Quichua word *ullu* for penis (related to Aymara ayllu). "In Quichua, however, the word ayllu is the name of a particular kind of weapon, called bola, or boleadora, in Spanish. In Peru, this weapon consisted of three metal or stone balls joined together by leather thongs. The connection between the three different meanings of the word ayllu: a social group, the male genitals, and the bolas, can be illustrated by a number of examples, as for instance a number of Aymara words from the stem urco" (Zuidema, 1964:72).

7. *A Human Skull and a Tuft of Hair*

The artificially deformed and trepanned skull (70.19.48) has been technically described by a skilled anatomist in this volume. Bandelier (1904:440) mentions specifically finds of trephined crania "from the eastern slope of the cordillera, near Pelechuco and Charassani", adding that "at the latter places but few were found, for the reason that human remains are usually decayed beyond recovery on account of moisture". Now we have, due to exceptionally favourable circumstances from Niño Korin, the skull of a man who died at 25 to 30 years of age. The lower jaw is missing, but otherwise the skull is very well preserved. A radiocarbon measurement with standard deviation has dated this skull to A.D. 755, but I must, however, for this result refer to my discussion (pp. 28–30) and to Dr. Hultin's paper (p. 185).

"Trephining and artificial skull deformation was practiced in Early and Late periods" (Bennett, 1946*c*: 36). Bertonio gives the word *sircamana* for surgeon. La Barre (1948:223–224) equated *sirkaq' amani* with the Aymara surgeon and found it very probable that "it was this practitioner who in ancient times performed the trephinings for which this region is famous among physical anthropologists and archaeologists". Paredes (1963:242) considers, however, the *yatiris* and *amautas* to have been the trephining experts. Bandelier could write in 1904 that "trephining is today practised in Bolivia, and probably also in the Peruvian sierra, by Indian medicinemen" (Bandelier, 1904:441) and he mentions Paloma, a "shaman or medicineman of the class called *Kolliri*" as having had a natural talent for surgery, "trephining with striking success although with the most ordinary cutting tools" (Bandelier, 1904:441; cf. Buschan, 1941:453). Already to Bandelier (1904:446) it was a source of surprise that he "had not been able to find any mention of trephining in the early sources". Ackerknecht (1949:638) stresses the same thing when writing that "strangely enough, no chronicle mentions trephining, though the operation was performed in Perú from pre-Inca times down to the beginning of the 20th century". He also discusses the various supposed reasons for trephining. According to Stewart (1950: 45–46), "the Paracas skulls furnish the earliest record of this custom. Elsewhere, the skulls are usually attributed to the Late cultural period."

The skull described in this work was found without any hair, but I found a tuft of human hair (Coll. 70.19.56a) well concealed in a long woven ribbon (Coll. 70.19.56). The ribbon was found with other objects (Coll. numbers 52–60) in a basket with a lid (Coll. 70.19.51), and these objects appeared not to have been opened before. Possibly the hair had some meaning. Karsten (1926:52) has dealt with human hair used by "Indian wizards for practicing nefarious magic". He has quoted Nordenskiöld's *Recettes magiques*, etc., (1907) and writes: "Thus, among the Aymará of the present day, when an Indian wants to harm an enemy, he procures a lock of his hair or a piece of his nail, and inters them in a tomb, being sure that the *chullpa* or death-spirit residing in the tomb will take hold of the person to whom the hair or the nail belonged". It is perhaps possible that the occurrence of the hair tuft in the Niño Korin grave might be explained in this way. Oblitas Poblete (1963:216) mentions human hair in Callahuaya love magic.

Through Arriaga we know that the Peruvian Indians venerated the hair of deceased important persons. He specifically describes one case as follows: "En casa de los padres de vn Indio principal, tenían escondidos vnos cabellos de vn gran Idólatra bisahuelo de quien los descrubrió, respetavan, y adoravan los cabellos, y la memoria de este Indio, cuyo cuerpo quemó el sobredicho Fray Francisco, porque le avían respetado mucho en vida, por ser consultador del Inga" (Arriaga, 1920:98. Cf. Valdizán and Maldonado, 1922, vol. I:447).

8. *Other Objects*

In the collection we found, beyond the objects already treated in this Introduction, a group of bamboo tubes used as containers, fur pouches, baskets, textiles, a single shawl-pin, several spatulas, a wooden mortar, pestles, etc. For all of these specimens, I refer to the descriptive part of the volume.

9. *Radiocarbon Measurements*

Several portions of *Ilex Guayusa* leaves found in the collection as well as the human skull have been subject to radiocarbon measurements in Sweden. An evaluation of the results must, however, be preceeded by the conclusions drawn from the facts related to the find and its general archaeologic character. I first recall that the find was reported to have been made in June 1970 in a tomb where all of the items were found.

Regarding the general ornamental style of the specimens we seem to have some kind of Tiahuanacoid material in front of us. When inspecting a photograph of the snuff tray 70.19.1 (fig. 5) Dr. Dorothy Menzel, Berkeley, has, however, concluded that this tablet probably belongs to the Middle Horizon Epoch 1 B in terms of sequence set up by her (Menzel, 1964). According to her work, "at a conservative estimate, subject to corrections when more radiocarbon determinations are available, the Middle Horizon dates from about A.D. 800 to about A.D. 1100" (Menzel, 1964:3). It has been possible for her to subdivide Epochs 1 and 2 "so that we can now distinguish Epochs 1 A, 1 B, 2 A, and 2 B". Dr. Menzel refers to a textile published by William J. Conklin (1970) and the amazing resemblances between it and some of the design details on the snuff tray 70.19.1. In a letter of October 13, 1971, she writes: "I think they must be exactly contemporary, and represent the strong religious movement that dominated the area at this time, and that linked the Tiahuanaco and Huari complexes." Sawyer (1966:132) speaks of "highland Tiahuanaco people who were establishing themselves at Wari, not far from Ayacucho". He considers the Wari to "have moved down from the mountains and overwhelmed the Nazca and other coastal people", around A.D. 700.

Bone from the skull 70.19.48 has as sample *St. 3667* (according to a report from the Laboratory for Radioactive Dating in Stockholm of September 13, 1971) given a result of 1195±100 B.P., or A.D. 755. Dr. Eskil Hultin (see page 192 in this volume) has pointed out that this value does not actually represent the historical time scale but a radioactivity analysis result, the historical time equivalent of which can be obtained by comparison with results from radioactivity analyses of material with known age. Such calibration experiments with wood, the age of which has been determined by the tree-ring method, has been done by a few laboratories. Calibration curves, slightly different for each of these laboratories are thus available, however not yet from the Stockholm laboratory. Hence it remains to use an average calibration curve for which differences between laboratories is an additional source of variation, adding to the standard deviation originating from the limited number of radioactive disintegrations which can optimally by counted in the analysis. Obviously, results can be recalculated with greater accuracy as soon as a calibration curve for the Stockholm laboratory becomes available. The present estimate is given by Dr. Hultin as a 95% confidence interval of A.D. 400 to 1100; the 50% confidence interval (the same chance that the correct date is inside the interval as outside it) is at present given as A.D. 650 to 850 (rounded off to the nearest even 50 years).

Four portions of *Ilex Guayusa* leaves were found in the collection, of which until February 1972 three have been tested for radiocarbon determinations.

1. From the package of leaves 70.19.20 b, found in an embroidered bag 20 a, a sample which had been pulverized and extracted with metanol was submitted to the Laboratory for Radioactive Dating, Stockholm. This sample, *St. 3440,* has with standard deviation given the result 830±100 B.P., or A.D. 1120 (the Laboratory's report of November 30, 1970).

2. From the quantity of *Ilex Guayusa* leaves found in the "ball" formed of a big *Duroia* leaf (70.19.41, p. 61), a sample was submitted to the same laboratory. This sample *St. 3439,* in the form of leaves, has been dated to 1557±100, or A.D. 375 (the Laboratory's report of November 30, 1970).

3. In October 1971, a portion of *Ilex Guayusa* leaves weighing 7 gr., from the contents in a bag 70.19.52 a, was submitted to the same laboratory. This sample 70.19.52 a, could not be analyzed until the beginning of 1972. The date has been given as A.D. 355±200, according to the Laboratory's report for *St. 3809* of February 17, 1972.

The age determinations A.D. 375 and A.D. 355 must be counted as contemporary and they coincide with the Tiahuanaco Epoch III radiocarbon dates presented by Ponce Sanginés (1969 b:102), by many archaeologists considered to be too early. The subterranean *Templete B* in Tiahuanaco is officially dated to Epoch III, 133–374 A.D. Kubler (1962:304) has given the 'Classic' phase of Tiahuanaco "a radiocarbon date about A.D. 300". The dates from Tiahuanaco referred to by Kidder II (1967:138) were published in the American Journal of Science, Radiocarbon Supplement, vol. 1,1959, pp. 54–56. The volume contains dates that Dr. Kidder had gotten from Chiripa and Pucara as well. In a letter to me of November 17, 1971, Dr. Kidder has, however, written that "frankly, I do not trust the Tiahuanaco dates; some of them certainly seem to be contaminated and others undoubtedly involved disturbances. I think the same thing is true of the dates we ran for Carlos Ponce Sanginés. However, I would think that Classic Tiahuanaco to be about A.D. 200." This latter statement coincides with that of Meggers and Evans (1963:96) who are placing *Regional States Florescent* from A.D. 200 to A.D. 600. According to them "about A.D. 200 the full agricultural potential of the coast had been reached and Classic Tiahuanaco was probably at its peak in the Titicaca Basin". The *City Builders* period with "the styles of Wari (often referred to as Coast Tiahuanaco)" with a "vigorous cult, symbolized by an iconography of Tiahuanaco—via Wari" they place from A.D. 600 to 1000 (*op.cit.*, p. 97).

It is evident from the Proceedings of the Twelfth Nobel Symposium (Olsson 1970), Plates I and IV, that there are systematic errors, varying with the age and originating from the time variation of the concentration of C14 in the atmosphere, and random errors, in radiocarbon dating. In the evaluation of the measurements written for this book by Dr. Eskil Hultin (p. 192) the systematic error for the period discussed here is estimated to have such a value that the objects should be dated about 75 years closer to our time than indicated by the radioactivity measurement.

The contents of the Niño Korin tomb, that is all the specimens described in my work (with a possible exception for the skull 70.19.48) must have been placed there in a given moment. As stated on page 61 it is, if we judge from the weft thread count for the four woven bags in the collection, possible that they have been woven by the same individual, and I cannot believe that the Indians during a time range of several hundred years went to a certain tomb and deposited leaves of *Ilex Guayusa* in it at irregular intervals. Hence I am disregarding the radiocarbon analysis of sample 1 above (A.D. 1120) as an accidentally outlying result, particularly as the sample sent for radiocarbing dating had been previously processed in an other laboratory for other purposes.

DESCRIPTION AND COMPARATIVE NOTES

CATEGORY A. *Five snuff trays of wood and a tube*

In the collection there are five snuff trays of wood (Coll. numbers 70.19., 1,19,21,23 and 33), all most remarkable and some excellently well preserved (figs. 5, 8–9, 11–12). Oblitas Poblete (1963) who uses the old term "tablillas de ofrenda" has in his pl. 88 published the wooden snuff tray redrawn and reproduced here in fig. 4. It was, as already stated in the Introduction, found by Dr. Edgar Oblitas in the region of Niño Korin and presented by him to the *Museo Tiaguanacu de la ciudad de La Paz.* Dr. Gregorio Cordero Miranda, who described this specimen in a newspaper article interprets the animal motif as being probably feline. The figure has been included here for comparative purposes and I find it appropriate to quote the description in Spanish as presented in Oblitas Poblete (1963:491–492) before I describe and give references to the snuff tablets in the collection 70.19.

"Tableta de madera de forma rectangular de fondo plano, curvado en su posición horizontal; una figura tallada, posiblemente de felino, orna un extremo de la pieza (sector de mayor anchura), muestra en la cabeza, delante de las orejas, una faja en relieve formando un arco que llega hasta el nacimiento del cuello semejando una corona, el cuerpo está en ligero relieve, en medio del cual se nota una cabeza antropomorfa, incisa, estilada, la con- (*should be* que) está ornada con dos rectángulos y en su parte final con incisiones paralelas transversales, tiene cuatro patas claramente talladas que terminan en tres dedos cada una, en la parte inferior de esta figura zoomorfa existe un signo escalanado y en la superior de la misma existe un signo inciso semejando una faja con rectángulos en cuyos extremos figuran cabezas ornitomorfas (cóndor). La posición del felino da impresión de encontrarse recostada con la cabeza levantada; siguiente a esta ornamentación hay un cavado de forma rectangular en bajo relieve; mide la pieza 176 mm. de largo, 70 mm. de ancho, 53 mm. de ancho mínimo y 8 mm. de espesor."

1. *Snuff tray 70.19.1*, fig. 5.

Material brown wood. Length 18.5 cm., slightly curved. Upper width 7 cm., lower width 6 cm., thickness 0.8–1.2 cm.

Similar in ornamental details is a snuff tray from San Pedro de Atacama, now in the National Museum of Chile, (No. 1164), originally published by Uhle (1912, fig. 4), later by Oyarzún (1931, fig. 9), Latcham (1938:46, fig. 2a) and recently by le Paige (1965, pl. 60). Father le Paige has in his work published several snuff tablets with angel drawings. In a letter of September 28, 1971, Dr. Dorothy Menzel, Berkeley, California, considers that they are "clearly of different style phases, in the same tradition, and probably span the entire Middle Horizon."

The standing (or, if we turn the tray sideways, floating) feline deity figure 70.19.1 with a protruding tongue has on his head a crown (Posnansky, 1945–1958, vol. II, pl. XXXV), the base of which seems to be the same animal element as is clearly observed in the floating angels of the Calle Linares lintel. The ornaments surrounding the cavity for the powder (these signs stand according to Posnansky for "movement and joint", 1945, fig. 16, p. 131) as well as other of symbolic importance are also common for the lintel and the snuff tray. Dr. Dorothy Menzel, has kindly called my attention to the fact that the motif on the stone fragment from Akapana published (upside down) by Créqui-Montfort (1906:540, fig. 11) is "also in the style of that lintel from the house in La Paz," According to her calculations, it should be "contemporary with it (the lintel) and earlier than other carvings from Tiahuanaco. Well, at least it should predate Middle Horizon 2." (Letter, Sept. 28, 1971).

Many details in the carving of the Akapana stone are of interest to a study of the snuff tray 70.19.1. The same could be said about many of the ornamental details on a 16 cm. long tubelike llama bone now in the Southwest Museum, Los Angeles. This specimen was purchased in Tiahuanaco in 1893 by Mr. Charles F. Lummis. (Information by Dr. Hasso von Winning, Hollywood, Calif., letter of October 31, 1971.)

Rowe (1971:117) has pointed out that "there are a number of conventions and ideas of Chavín religious art which are also found in the religious art of Huari and Tiahuanaco in the Middle Horizon. These conventions and ideas comprise the Staff God pose, winged or floating angels—sometimes with bird heads—and the use of crossed fangs in non-feline, non-snake faces to suggest a supernatural character. The Staff God pose is fullface with the arms outstretched and a staff or other ceremonial object in each hand. In Chavín it appears to have been used only for one particular deity, but in Huari and Tiahuanaco religious art it was used for a variety of deity figures, male and female. A floating angel is an attendant figure shown with the body more or less horizontal in the air." Later in the same context Dr. Rowe continues: "The use of crossed fangs in non-feline, non-snake faces is a common convention in the art of Huari, but only one example of it is known from the Tiahuanaco area: a carved lintel from La Paz on which the angels are shown with crossed fangs. This lintel is in a slightly earlier style than other Tiahuanaco sculptures, judging from the development on the Huari area."

The lintel mentioned by Rowe has the design shown in fig. 6 (Rowe's fig. 23, p. 117, and originally in Posnansky, 1945–1958, vol. II, fig. 140a). I have quoted Rowe in detail and reproduced the motif from the stone lintel from the house in Calle Linares, La Paz, as there are so many similarities in the lintel motif and that of the snuff tray in my fig. 5. The figure on the snuff tray now in Gothenburg should, however, be referred to the type of specimens which Rowe (1971:117, footnote 11) describes in the following way: "A stepped-nose being, common in Tiahuanaco religious art, is also depicted with crossed fangs, but in this case the whole head may be intended to be a feline."

The figure has lost the inlays for a big eye and for one of the shoulders. On the breast is seen a human head, the eye of which also has been inlaid. Over the big eye is a snake, and snakes around the eyes are also seen on Paracas embroidered mantles (see Bird and Bellinger, 1954, pls. LIV–LV).

In his right hand the deity figure carries a human head in what supposedly should be two plaits, or, less probably, tubular textile braids as known from Paracas (Bird and Bellinger, 1954, pl. CXX). In the left hand we see a sceptre or staff of an "undulating form" which ends in "fingers" at the upper, and a head at the lower end. The "finger" element on the top could be explained as a simplification of the three element top of a staff as we see it on wooden spoons with carved handles from a Coast Tiahuanaco find published by Keleman (1956, pl. 275 c). On the figure seen in spoon 4 of Keleman's plate 275c, we also observe a human head at the lower end, and there are also other details of the incised spoon handle ornaments which we recognize in the snuff tray.

Two "undulating" staffs are shown on a bowl in the Pucara style with two running angels published by Posnansky (1945–1958, vol. III, pl. LVI B, text p. 89) and later by Rowe and Brandel (1969–1970, pls. II and XVI) and again by Rowe (1971, fig. 25), but we must consider that "between the Pucara style and the styles of Huari and Tiahuanaco there is a long gap, and no style which might be transitional is now known" (Rowe, 1971:120), even if examples of Pucara-style sculpture have been found in Tiahuanaco (Rowe, 1971:118). It is difficult to understand why real staffs should be presented in an undulating form as in these cases. Upon inspection of the snuff tray in Gothenburg Dr. Tom Zuidema suggested that the "staff" be based on a textile element, and we find a support for this in the partly repeated ornaments on the figure's girdle or skirt. Fingers are, as we know, found at the end of Paracas turbans (see *e.g.*, Bird and Bellinger, 1954, pl. XIII), but they could hardly have been used pointing upwards.

At the lower end of the rectangular cavity are two fish signs separated by a groove (see Posnansky, 1945–1958, vol. I, p. 119, fig. 7:4, a side view of the *Orestias* or *boga* fish of Lake Titicaca).

On the head of the figure we find the "Winged Eye" motif (see Posnansky, 1945–1958, vol. I, p. 123, and pl. XXII) here in a somewhat primitive style and not as elegant as on, *e.g.*, the low relief sculpture on a stone from S. Pedro de Tiquina, Bolivia, now in the Gothenburg Ethnographic Museum (Coll. 44.12.21, fig. 7 A), or the running figures from the "Gateway of the Sun" at Tiahuanaco (fig. 7 B).

Regarding the hands, we notice the thumb and only three more fingers on each of them. According to Posnansky's theory (1945–1958, vol. I:132), the way of expressing a deity's hand was by omitting the little finger, while a man was depicted with five fingers, as is the case in our snuff tray 70.19.33 (fig. 12).

The figure to the left of the deity's right arm could possibly be a so-called Stair Case sign with a double wavy sign below.

It looks as if the Indian who once carved and incised this snuff tray had a feeling of *horror vacui* as practically the whole surface above the empty rectangular cavity was filled with symbolic carvings. This is also true for other trays in the collection.

I have discussed some motifs of the snuff tray with Dr. Dorothy Menzel, Berkeley. As already mentioned (p. 28), she has after inspecting a photograph of the specimen concluded that this tablet probably belongs in Middle Horizon Epoch 1B (letter of October 13, 1971). In her letter she also refers to a textile from Peru which she considers exactly contemporary (cf. p. 28). Among the design details which constitute an amazing resemblance between our snuff tray 70.19.1 and this textile, which has been published by Conklin (1970), she specifically mentions the symbolic "tail feather" design at the top of the staff of the snuff tray "like the corresponding ones on the textile: narrow "feathers" in zigzag or wavy alignment."

Dr. Menzel continues: "The zigzag pattern in the staff segments is a characteristic one for the highest ceremonial style of offering pottery in the Huari style of the sierra in Middle Horizon Epochs 1 A and 1 B . . . It is one of the variations of staff ornament. Solid circles are one of the designs used for garments in the ceremonial styles of Middle Horizon 1 in the Huari area and for Middle Horizon 2 in the Tiahuanaco area. In the Conchopata style, the offering pottery of the Huari style of Epoch 1 A (near Ayacucho) there is one particular figure only that has it, one I call a "walking angel" or Angel D. It evidently signifies a tie-dyed garment. . .. Small irregular outlines and unoutlined dots of the kind you have on your tablet, in single-row alignment as staff decoration and the decoration of staff equivalents, first appears to my knowledge in Middle Horizon 1 B, where I have seen it on what I call the Robles Moqo style, the ceremonial offering pottery of this epoch." (Dr. D. Menzel, letter of Oct. 13, 1971).

The textile published by Conklin "is reportedly from a site between Pisco and Ica" (Conklin, 1970:15). According to Conklin "it would seem clear that on several points the textile is stylistically closer to Tiahuanaco than to any known Peruvian textile or ceramic style. The absence of any comparable stylistic material from the Ica area and the reused condition in the burial suggests a non-local origin. There are at least two possible explanations. The first would be that the textile is, in fact, an imported piece, having been actually designed and woven in Tiahuanaco, Bolivia, and carried to the coast via Huari marking the beginning of the Middle Horizon in a way suggested by Bennett on the basis of other evidence. The second would be that the textile was woven in highland Peru by a local group which was so strongly connected to Tiahuanaco that the work is, for us, indistinguishable from what must have been the weaving tradition of that culture" (Conklin, 1970:23). Mr. Conklin's textile, "probably a ceremonial cloth or wall hanging," excellently published by the Textile Museum in Washington, is evidently of great interest to the iconography in the Niño Korin material. We can, *e.g.*, identify the full-face deity represented in the center of the textile (Conklin's fig. 10) with its split eyes and the surrounding ornamental details with the corresponding full-face deity on basket 70.19.50 described in this volume (see p. 51). From the drawing of this basket (plate I and figs. 41–42) we are able to conclude that Mr. Conklin's reconstruction drawing of his Peruvian textile (Conklin's fig. 6) is correct for this central part of tapestry weaving. A full-size deity with a square, framed face with split eyes and the same kind of three ornamental details above the head is observed in the Middle Horizon Epoch IB pottery vessel in Robles Moqo style which was published by Menzel (1968, colour plates III and IV). The conventionalized motif of the basket 70.19.39 (figs. 37–38) could possibly also be explained as a form of the full-face deity with the three ornamental details above and below the head.

2. *Snuff tray 70.19.19*, fig. 8.

Material dark brown wood, partly carbonized and twisted. Length 16 cm., upper width 5.7 cm., thickness 0.5 cm.

The central motif of this specimen is a standing crowned left-turned winged bird (condor) with a hooked beak. The surface is partly worn, with many cracks, and so dark that a detailed study is difficult. For the photography it has been necessary to chalk the major details.

The composition and general type of the figure reminds us very much of Posnansky's "Head of Kochama" (1945–1958, vol. II, fig. 100c) with the same type of wing and crown. The last has been cut out from the surrounding upper part of the left border, probably a staff, and the wing at the right. The technique used with irregular cuttings in the tray gives us an impression of a cutout, at the first glance misleading in such a way that the back of the head seems to form a nose. Like some of the beaked lateral figures of the "Sun Gate" in Tiahuanaco (a monument which according to Vivante, 1963, should not carry this misleading name), the bird carries something in his beak. The shallow rectangular cavity measures 3.5 × 7.5 cm.

A dominating trait in this and other representations of the falconiform birds (including the condor) is the wing. Posnansky (1945–1958, vol. I:140–141) observed the importance of the wing iconography and took the sign as "an attribute of divinity." In a representation of a wing he found a "Condor" as a "carrying and executing" sign "of the will of the main figure." Even if Posnansky's explanations in many cases are very speculative and thus must be taken *cum grano salis*, he was perhaps here on the right track, as it recently has been possible for Zuidema (1967:49) to explain the importance of the Inca custom reported by Albornoz (1967) of binding another reigning person by a contract to the ruling Inca. According to Albornoz and Zuidema, two wings of an *halcón* (in Quichua *huaman*) were used, of which the Inca kept one and gave the second to the other ruler or chief. Zuidema stresses in this context the importance of the condor as the greatest of the *Falconidae* for the Andean world and its religious and political concepts. In the play between the totality represented by the Sun or Viracocha, the Creator, and Pachamama (Mother Earth), one finds the *huaman* (condor) as the god of the mountains and heaven, together with the *amaru* (snakes coming from openings in the earth), representing subdivions. I have tried to summarize this from Zuidema's text in Spanish (1967:50). Because of the time gap and the lack of text information from the remote Tiahuanaco we will perhaps not be able to prove a common identity shared by the condor motif in the Tiahuanaco culture and the Inca religious ideas analyzed by Zuidema. We can, however, certainly rely upon old pan-Andean conventions and religious concepts. These took their expression in the art executed not least of all on ceremonial objects like snuff trays, as it was by means of these tablets and the powders associated with them that a closer contact with the great deities was established.

3. *Snuff tray 70.19.21*, fig. 9.

Material light reddish brown wood. Length 14 cm., width 3.5 cm., thickness upper end 1 cm., lower end 1.2 cm. Length of rectangular cavity 9.5 cm. It has a groove at the lower end.

The incised decoration of this tray is limited to six bird heads and two four-sided figures one in each of the two upper fields. The ornamented area has namely been divided in two horizontal fields of which the upper has one dividing vertical line, and the lower two vertical lines. All the bird heads are pointing towards the upper edge of the ornamented field. In the upper left part we see two heads, one turned left, the other right. All other heads are turned right, and one has been placed in the upper right field; the other three are found one in each of the three lower fields.

We see the same kind of hooked beak in the painted figure of a condor found on a pottery vessel from Tiahuanaco once presented by Arthur Posnansky to the Gothenburg Ethnographic Museum (Coll. 28.3.23, fig. 10).

4. *Snuff tray 70.19.23*, fig. 11.

This wonderfully preserved and elegantly executed snuff tray has been made of brown wood. Length 17 cm., upper width 6.5 cm., lower width 5.5 cm., thickness 0.5–0.6 cm. Length of the rectangular cavity 7.5 cm.

The dominating motif is a standing winged bird looking left with uplifted head. On the neck there are two horizontal bars which probably mark the neck feathers or "drip-protection" of the condors. Between the wing we see a human skull and a crossed circle or dot. The bird's tail feathers are presented horizontally, and just opposite them the ventral part is bulging. In the body is an angular sign, possibly of the type Posnansky first used to call "Sex", "since it was found sometimes in that part of the human or animal body which corresponded to the genitals" (Posnansky, 1945–1958, vol. I:128) but later considered to be a sign for "earth and sky". The left part of the incised surface has three groups of what seems to be double "Staircase" signs or step blocks. The rest of the surface is filled with figures whose meanings are unknown but which appear to be highly symbolic. The whole tray is a masterfull example of Tiahuanaco wood carving.

5. *Snuff tray 70.19.33* (fig. 12).

Material light brown, not heavy and comparatively soft wood. Length 10.5 cm., width 2.8–3 cm., thickness 0.6 cm. Length of cavity 6.5 cm.

This small and unusual snuff tray has been carved in the form of a right clenched hand or fist. The fact that all five fingers are seen suggests, according to Posnansky's theory referred to on page 34, that they belong to a human hand, not that of a deity. The nails and joints are indicated by shallow carvings, and—not seen in the photograph—the joints of the thumb and its nail are also carved in this way.

Through Bennett (1934:434 and fig. 25) and others we know of the great importance of hands in Tiahuanaco stone sculpture. What specific meaning a fist had for the Tiahuanaco Indians we cannot know, but we have much information from the Aymara on this topic. Bandelier (1910:105) mentions "clenched fists" among the Callahuaya white alabaster fetishes. Ponce Sanginés (1969:153) refers to the *maki* of the callahuaya; the maki is a talisman in the form of a human hand, which, with a circle indicating a coin, is considered to bring good luck and fortune. Tschopik (1946:563) says that "amulets the shape of a human hand prevent fatigue and give luck in weaving." For the two last references I also refer to Métraux (1949b: 582–583).

6. *Bamboo tube 70.19.3* (fig. 13).

In Category A of this description I include a straight tube (70.19.3) which was found with the specimens 1–10 in the collection, together with the snuff tray number 1, and other objects.

The length of this tube, probably of *Arthrostylidium* sp. (personal communication by Dr. R. E. Schultes), is 24.5 cm. It is oval with an outer diameter of 1 cm. and an inner diameter of 0.5 cm. Starting 0.3 cm from one of its ends there is a 1.7 cm. broad strand of wound Z-spun cotton which has been covered with wax. During my examination of the tube I found in the middle of its length a very small quantity of a fine grayish powder which was sent to the Department of Toxicology of the Karolinska Institutet for an analysis which, however, proved to be fully negative (letter of June 30, 1971).

The snuff tube discussed here is not the only one known from the region. In the Introduction I mentioned a fragmentary specimen in the Archaeologic Museum, La Paz, and I also quoted Oblitas Poblete (1963:493) who refers to tubes from the Niño Korin region in the following way: "Fragmentos de caña hueca que posiblemente sirvieron para inhalar polvos, muestra algunos incisos muy difíciles de identificar, pero son motivos tiaguanacotas, longitud 21 cms."

Straight tubes associated with finds of snuff trays seem to have had a long tradition in the Peruvian area. Dr. Frédéric Engel of the *Instituto de Antropología y Agricultura Precolombina* in Lima has kindly sent a photograph of a bone tube from the museum annexed to the Institute (letter of Sept. 15, 1970). This tube (Cat. No. B. 768, Photo 12201) comes from "a pre-Chavin shell mound filed 12b XI-300 in Asia, Omas basin, central coast of Peru, a mound probably belonging to the first maize eating settlers." He also provided me with a photo of a fragmentary but typical snuff tray of wood with a sitting human figure (headless) serving as a handle. This wooden tablet is said to have been found in "Puerto Nuevo de Paracas (site filed 14a VI-55), a village on the North shore of the bay of Paracas (middle South Coast of Peru). The village contains brown pre-Chavin pottery ware and also classic decorated Chavin." A third photo was received, namely of a bone tablet similar to that from Junius B. Bird's find in Huaca Prieta published by Wassén (1967:257, fig. 17). This tablet (Cat. No. B.260, Photo 5845) was found "in Chavin village 12b XI-5, Asia, mouth of the Omas basin, central coast of Peru." Dr. Engel further writes on this find: "A complex tube (lost before photographing) was found with the tablet (at No. B. 176)." For comparative purposes I herewith publish Dr. Engel's wooden tablet from Puerto Nuevo de Paracas and the bone tube from Asia, Omas basin (fig. 14–15).

From a much later and evidently strongly Tiahuanaco-influenced period are a straight snuff-inhaling tube of bone and one of wood with thread at its end, both from Chiu-Chiu, Province of Antofagasta, Chile, now in the Gothenburg Ethnographic Museum (Coll. 42.4.194 and 192). These tubes were published by Holmstedt and Wassén (1963:19, fig. 7b and c, and they are also seen in Rydén, 1944, fig. 115C and D).

CATEGORY B. *Bamboo tubes used as containers*

In the collection from Niño Korin there are six bamboo tubes all of which evidently have been used as containers. The Coll. numbers for these specimens are:

79.19.2a: A single tube (fig. 16B).
12a: A tube containing two reeds 12b–c, see Category E (fig. 17A–C).
13a: A single tube (fig. 16A).
14a–b: A tube with a stopper (fig. 18A).
15a–b: A tube and a lid (fig. 19F). For the enema syringe 70.19.15c, found in this tube, se Category E (p. 44).
16a–b: A tube with a stopper, the tube covered with animal skin (fig. 18B).

All of these tubes contained minimal quantities of a powder-like material which, it was thought, might be either the remains of some kind of powder used in connection with the tubes or else only simple contaminants. The samples which could be prepared (Coll. Nos. 2b, 12d, 13b, 14c, 15d, and 16c) were submitted for analysis to the Department of Toxicology of the Karolinska Institutet, Stockholm, however, in all cases these powders proved to be devoid of alkaloids (see the report by Holmstedt and Lindgren in this volume).

A short description will now be given of the tubes.

1. No. 70.19.2a. Length 17.7 cm., diam. 1.9 cm. Without ornamentation. Found wrapped together with specimens 1, and 3–10 in the collection. Fig. 16B.
2. No. 70.19.12a. Length 16.5 cm., diam. 1 cm. Without ornamentation. In this bamboo tube were found two reeds, 70.19.12.b–c. For a study of these and other reeds in the collection see Category E. Fig. 17A–C.
3. No. 70.19.13a. Length 18.8 cm., diam. at the open end 2 cm. Without ornamentation. Fig. 16A.
4. No. 70.19.14a–b. The length of this tube is 18 cm., its diam. 3 cm. It has at the open end a 3 cm. wide lashing of thread which has been coated

black with pitch. To this tube belongs a stopper, 3.5 cm. in length. This stopper is covered with leather and has at its top a coil of leather strips. From the edge of the leather cover of the stopper are remnants of cotton strings forming a cord so that the stopper could be removed easily. Fig. 18A.

5. No. 70.19.15a–b. Length 21 cm., diam. at the opening 2.3 cm. This tube was found with a thin lid of skin. The lid has been inspected by Dr, Johannes Lepiksaar, Museum of Natural History in Göteborg, who considers it to have come from a mammal. The material is very thin, and on the inside of the lid we found remaining hair, which means that the skin had been turned inside out. For the enema syringe 70.19.15c found in this tube see under Category E. Fig. 19F.

6. No. 70.19.16a–b. Length 19 cm., diam. 2.5 cm. To this bamboo tube belongs a 3 cm. long stopper of the same construction and type as that in the tube 70.19.14. The coil has been made of leather strips, but there are no cotton strings for removing the stopper.

The tube has, to a total length of 17 cm., a dark red-brown coating of what Dr. Johannes Lepiksaar considers to be howler skin. This covering has no lateral seam, and it has been drawn over the tube and sewed up at the end. At the upper end of the coating we find a cotton string which might have been fastened to the stopper. Fig. 18B.

CATEGORY C. *Containers made of fruits*

There are two containers made from fruits in the Niño Korin collection.

1. No. 70.19.31a–b. Fig. 20. This specimen consists of a 10.5 cm. long bottle-shaped container made from a fruit which professor Gunnar Harling of the Institution for Systematic Botany of the Gothenburg University recognized as lecithydaceous. It has been identified specifically as *Cariniana decandra* Ducke by Dr. R. E. Schultes, Cambridge, Mass., who also informs me that this fruit is found in the Rio Madeira basin. The fruit container has an animal skin coating on which some tufts of red-brown hair have been saved thanks to an outer skin covering. Both Dr. Sparre and Professor Asplund believe the coating of the container to be howler skin; Dr. Johannes Lepiksaar at the Natural History Museum of Göteborg agreed with them upon an inspection of the specimen. The coating has been applied in the same way as that used for the bamboo container 70.19.16,—that is, it has been drawn over the fruit and sewed up at the bottom.

When found, the container had, as already stated, an outer skin covering which was tightly secured around the rim of the fruit with cotton thread. This protective soft skin (length 15.5 cm) has a seam from the upper to the lower edge. Dr. Lepiksaar considers it possible that this prepared animal skin comes from a monkey. The total length of the container, including the outer skin, was 21 cm. when found. The container had never been opened until it got to Sweden, but unfortunately it was found empty except for only a very limited amount of powdered substance (70.19.31 c) which has proved to be devoid of alkaloids (see the report by Holmstedt and Lindgren in this volume).

2. No. 70.19.32. Fig. 21. For this container (size 5 × 7 cm.) the Indians used a *Lagenaria vulgaris*, which was polished. The botanical determination was made by Professor Gunnar Harling, Göteborg, and Dr. Benkt Sparre, Stockholm.

As is seen in fig. 21 this calabash has a horizontal and vertical winding of yarn, which is red and yellow. Mrs. Margareta Anker of the Gothenburg Ethnographic Museum has found that both the yellow and the red woolen yarns are two-ply Z-S-spun. Where the threads cross they are steadily secured to each other. From the neck goes a 25 cm. long Z-spun six-ply twist made of two yellow and four grayish-white S-spun threads. This twist has been fastened to the other side, and the container was carried in this twist.

The container was found empty with a dried bluebottle fly tightly squeezed in the opening.

In the find by Dr. Edgar Oblitas at Callijicho, now in the National Archaeologic Museum in La Paz, there is a pair of gourds of this kind (see fig. 1) but without the yarn winding. I have referred to the museum label in the Introduction. In Oblitas Poblete (1963:492) such a gourd is described as "calabaza o porro periforme con abertura circular en un extremo, sin decoración; mide, altura 50 mm., diámetro máximo 38 mm., boca 15 mm." The Highland Bolivian Indians might have received these gourds from warmer regions. Rowe (1946:245), following Cobo, reports how the Inca got them by trade from such areas.

CATEGORY D. *Fur and skin pouches*

Three pouches of animal skin were found in the collection. (Coll. Nos. 70.19.8 a, 9 a, and 57, figs. 22–23).

Two of these (8a and 9a) were found wrapped together with the specimens 70.19.1–7 in the blue ribbon catalogued as 70.19.10.

1. No. 70.19.8a. Fig. 22A. A 20.5 cm. long pouch of animal skin with hair. Dr. Johannes Lepiksaar, Göteborg, who inspected this specimen considers the skin to have been taken from an extremity of one of the species of llama animals. Wool from this pouch has been submitted as sample 5 to two experts of the Swedish Institute for Textile Research, TEFO, Göteborg, research engineers Thomas Liljemark and Helge Hjalmarsson. According to their report published in this volume (p. 159), the material in question may be alpaca hair.

When the pouch was opened only a limited quantity of a "powder" was found (70.19.8b), which when analyzed in Stockholm proved to be devoid of alkaloids (see report of Holmstedt and Lindgren in this volume).

2. No. 70.19.9a. Fig. 23. A 17.5 cm. long pouch of skin, partly with remaining hair found together with the specimens 70.19.1–8 wrapped in a blue ribbon, No. 10.

Dr. Johannes Lepiksaar of the Museum of Natural History in Göteborg has inspected this pouch and believes that the skin possibly was taken from the ventral part of a South American deer.

This pouch was found tightly closed; when opened, we found it yielded a considerable amount of macerated vegetal material (70.19.9b). This material has been subjected to pharmacognostical research and analysis by Wolmar E. Bondeson, Dr. of pharmacy, Stockholm, and according to his paper published in this volume (p. 177), we have here a very early proof of the use of a *Nicotiana* in South American archaeological material.

3. No. 70.19.57. Fig. 22B. A 24 cm. long pouch of the same type as No. 8a in the collection. This pouch without any contents was found together with many other specimens in the basket, 70.19.51a. According to Dr. Johannes Lepiksaar, Göteborg, the skin comes from an extremity of a species of llama (cf. No. 8a).

CATEGORY E. *Reeds and putative enema syringes*

As already mentioned in the Introduction, we find in the collection a number of reeds and some specimens of enema syringes which make me believe that at least some of the reeds now without a bulb or with only the ligament left should be considered as shafts to such instruments. The collection numbers are 70.19.6, 7, 12b–c, 15c (a complete enema syringe), 25, 26, and 27.

1. No. 70.19.6. Fig. 19D. A 14 cm. long thin reed with a wiring of thread at one end. Some kind of a bulb probably has been attached to this end, as may be deduced from the other finds. Diam. 0.4 cm.
2. No. 70.19.7. Fig. 19E. A reed, length 12 cm., diam. 0.3 cm. At the end of this reed we see a wiring of cotton thread (see p. 171) which holds the completely dried remains of what can be said to have been a bulb of skin.
3. No. 70.19.12b–c. Fig. 17B–C. Two reeds, 13 and 12.5 cm. in length, both found in the bamboo tube 70.19.12a (fig. 17A). The reed 12b is just a simple thin straw, while No. 12c, has a wiring of cotton thread, as No. 6.
4. No. 15c. Fig. 19F. This instrument is the most interesting in the collection of reeds as it was found intact in the tube 70.19.15a. The length of this reed is 13.5 cm., and at one of its ends we see a well preserved but dried bulb of skin, attached to the reed with a winding of cotton thread. This instrument, which I believe to be an enema syringe, is of the same type (but with a longer shaft) as the two enema syringes found by Erland Nordenskiöld in a chullpa grave in the Ollachea Valley (Etnografiska Museet, Stockholm, Coll. 06.1.489–490, see p. 22, fig. 3). After his inspection of 70.19.15c, has Dr. Johannes Lepiksaar of the Nat. Hist. Museum in Göteborg considered this "bulb" to be a section of an intestine rather than a bladder.

The instrument 70.19.15c, was later submitted to two dermatologists in Gothenburg, Alf Björnberg, M.D., and Håkan Gisslén, M.D., who in collaboration with pathologists performed a microscopic examination on a small piece of the dry bulb. The piece was incubated in water for 24 hours and stained with van Gieson.

According to their report "the specimen consisted of elongated cells in bundles which may correspond to smooth muscular tissue. It was not possible to identify the organ from which it originated."

5. No. 70.19.25. Fig. 19B. A 14 cm. long thin reed.
6. No. 70.19.26. Fig. 19A. A 12 cm. long reed with a winding of cotton thread at one end (see p. 171). Cf. No. 70.19.6.
7. No. 70.19.27. Fig. 19C. A 14 cm. long reed with a winding of cotton thread at one end (see p. 171) which keeps a completely dried "bulb" of skin attached to the tube. Cf. No. 70.19.7.

CATEGORY F. *Spatulas of wood and bone and a wooden probe* (?)

In the Niño Korin collection we find four spatulas of wood (of which one is wonderfully well preserved) and one of bone. The collection numbers for the wooden ones are 70.19.24,29,36, and 40. The specimen of bone is No. 70.19.34. As seen in fig. 1, there is spatula of the same type in the collection found by Edgar Oblitas at Callijicho (now in the Nat. Arch. Museum in La Paz), described by Oblitas Poblete (1963:492) as "espátula o cucharita de hueso de mango largo, sin ornamentación, mide largo 120 mm., ancho 14 mm., espesor 4 mm." There also exists a beautiful spatula of stone with a jaguar handle published by Posnansky (1945–1958, vol. III, pl. LXXI A) and belonging to a snuff tray of stone also published by Posnansky and by Wassén (1967:280, fig. 30). The latter spatula now in the Museo Etnográfico in Buenos Aires has been redrawn for this volume after a photo in the Gothenburg Ethnographical Museum (fig. 24). One wooden spatula of a related type with a figure handle and found in Calama has been published by Boman (1908, vol. 2, fig. 173, pl. LXXIII). The spatulas mentioned here, including those from Niño Korin, all look like modern salt spoons, and one gets the impression that the Indians using them were measuring limited and defined quantities of certain substances.

1. No. 70.19.24. Fig. 25B. Spatula of wood. Length 11 cm. Partly carbonized. Handle destroyed but probably was of the same type as in 70.19.29.
2. No. 70.19.29. A beautifully preserved spatula of dark wood. Length 11.5 cm. Fig. 26.

This spatula has a handle in the form of the *boga* fish (see Posnansky, 1945–1958, vol. I:119, fig. 7), and evidently the same fish has been depicted on the snuff tray found by Dr. Edgar Oblitas Fernández and now in the Nat. Museum Tiahuanaco (see fig. 4). It is the fish named *quesintuu* or *quesi* by Bertonio (1879, vol. I:96), who relates (vol. 2:291) that *Quesintuu*, "otra especie de bogas", had a sister named *Umantuu* (from Aymara '*uma*' 'water'), and that Tunuupa ('God') sinned with both of them, "according to what is told in the legends of the Indians". The boga was thus a figure of mythological importance. The mythological motif with the two sisters has been treated more in detail by R. T. Zuidema (1972), and he points out that "similar data from Huarochiri refer to Pachacamac's two daughters with whom Viracocha went to sleep in the Ocean".

3. 70.19.36. Fig. 27. This 11.8 cm. long spatula of brown wood has at the upper end fragments of thread around the handle, evidently from a carrying string.
4. No. 70.19.40. Fig. 25A. This wooden spatula which was found broken and twisted has a length of 14.3 cm. Part of the handle is missing.
5. No. 70.19.34. Fig. 28. A 14 cm. long spatula of bone in the shape of a wavy fish with two big round eyes and fine incised ornamentation along

the dorsal side from head to tail. The ventral side has no ornaments, only a rounded depression and a shallow groove. The rounded depression has been made as deep as possible without breaking through the bone. A Pucara style stone sculpture which has ornamental features in common with this bone specimen has been published by Bennett (1946b: pl. 38).

6. No. 70.19.28. Fig. 30A. This specimen of light reddish brown wood, possibly a probe, is 15.5 cm. in length. It has a pointed end, now partly broken, and is now slightly bent, originally this object must have been straight. The upper end has circular carvings perhaps intended to facilitate the use of the possible probe when held between the fingers.

CATEGORY G. *Mortar and pestles, wooden parrot stick*

In the find from Niño Korin in the National Archaeologic Museum in La Paz there is also a wooden mortar (see Introduction), and in Oblitas Poblete's Plate 87 in his book from 1963 there is a picture of a mortar from Callijicho described in the following way: "Mortero de madera con un hueco en su parte central, de base redondeada, se observa ligero desgaste en su interior, indudablemente por el uso que se hizo de él; paralela al borde exterior, una linea incisa horizontal rodea la pieza; mide altura 21 mm., diámetro máximo 53 mm., boca 32 mm." (Oblitas Poblete, 1963:492).

In the Niño Korin find described in this volume we have one wooden mortar with carved ornaments, one pestle of wood, and one of bone. To this group I also attach a wooden stick with a parrot figure as a possible pestle.

1. No. 70.19.30. Fig. 29. Wooden mortar. This beautifully preserved object measures 5.5 cm. in height and it has an even, smooth bottom, with a 4 cm. diam. The upper diam. is 4.7 cm., the inner diam. 3.7 cm. The mortar has been hollowed out to a depth of 2.5 cm. The interior bottom is flat. Round the mortar we see a motif which has been repeated in five vertical sections with only minor differences in the circles and squares which are incised in these fields. The motif might possibly be a "winged eye".

2. No. 70.19.38. Fig. 30B. A 15.5 cm. long wooden pestle with a series of seven incised circles at the thicker end. Dr. Edgar Oblitas found several pestles of this type (see fig. 1), described as follows: "Cuatro manos de mortero trabajadas en madera, tres de las cuales muestran en sus extremos gruesas incisiones circulares, posiblemente decorativas y en los extremos opuestos huellas de posible encasquilladuras metálicas o forros de cuero para darles mayor consistencia, su longitud es de 19 y 20 cms. con un grosor de 1 a 1.5 cms. de diámetro" (Oblitas Poblete, 1963:492–493).

3. No. 70.19.35. Fig. 30C. A pestle of bone, 13.8 cm. long. At the thicker end the bone has become darker, as if from use?
4. No. 70.19.37. Fig. 31. This stick of wood has a length of 21.5 cm. and a diam. of 2 cm. It is crowned with the figure of a parrot which has lost the inlays for the eyes. The stick might very well have served as a pestle, as it appears to be somewhat worn at the end. It might also have served as a ceremonial stick, as some of the scepters in the Tiahuanaco culture have borne bird figures (see Posnansky, 1945–1958, vol. I, pl. XXXVIII).

CATEGORY H. *Weapons*

Two broken arrows and a three-ball bola are the weapons found in this collection. For some views on the occurrence of the broken arrows and on the symbolism involved in the word for and use of the bolas, I refer to the Introduction (p. 24). Here some technical remarks will be made.
1–2. Nos. 70.19.4 and 5. Two arrow shafts. Figs. 32–33. Both found together with objects 1–3 and 6–9 wrapped in the blue ribbon No. 10.
No. 4 is 27 cm. in length. This arrow shaft (fig. 32 B) which like No. 5 (25.5 cm) might well be *Gynerium sagittatum,* has been broken at both ends. There are no feathers left, but the shaft has still a winding of vegetable fibers (see Report p. 171) where feathers could have been fastened as is the case with No. 5. This arrow shaft (figs. 32A and 33) still possesses its feathering, and the end of the shaft has been protected by cotton thread wrapped round it (cf. Nordenskiöld 1924:48 for the Atsahuaca and Tambopata-Guarayo, "as well as a number of Indians from the Ucayali area" for this method of protecting the end of the arrow). The fibers wound to keep the feathering in place are of some vegetable material (letter from TEFO, Göteborg, Helge Hjalmarsson, of July 30, 1971). The arrangement of the feathering seems to be of the type which Métraux (1949a:240) with a modification of terms used by Meyer (1898) and Nordenskiöld (1924:45–46) calls "flush", with a subdivision: "wrapped feathering." This method used to be called "arara"-feathering, and Nordenskiöld (1924:47) has mentioned the Huanyam, Movima, and Huari as using it.
3. No. 70.19.17a–d. Fig. 34. The three-stone bola was found with one stone connected to its cord of fibers (a), two lose stones (b–c) and another piece of the same cord (d). The stones are wrapped with skin. This kind of weapon is typical for and distributed throughout the region where it was found. For the importance of the bola weapon I refer to the Introduction (p. 25).

CATEGORY I. *A tupu or shawl-pin*

No. 70.19.18. Fig. 35. The only metal object in the collection is this *tupu*, 21 cm. in length. The flattened disk is 3 cm. broad. Thanks to the Manager of Laboratory, Tekn. lic. Staffan Andréasson of the SKF Göteborg, Nordic Region, the *tupu* was directed to Tekn. dr. Jan Fridberg, Manager of the Metallographic Laboratory, Hellefors Jernverk, Hällefors, Sweden, for a chemical analysis. According to his report of April 4, 1971, the investigation was performed with "an atomic absorption method which gives good precision even when very small quantities are analysed." In this case a 10 mg. sample was weighed and tested. As can been seen from the *Analysis certificate* the tupu is made of very pure copper.

A metallographic investigation of the tupu in a lightmicroscope was also carried out (see photos in fig. 35). From the photos it can be seen that the tupu had been annealed after the last forging operation. The black round zones on the photos are copper oxide (Cu_2O).

ANALYSIS CERTIFICATE

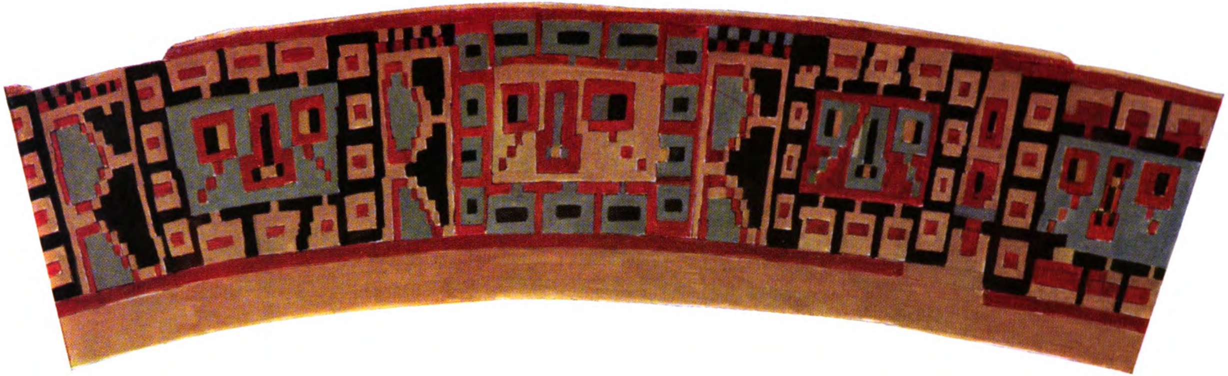
Chemical analysis of a tupu from Dep. La Paz, Bolivia, No. 70.19.18.

Cu	Ag	Zn	Mg	Si	Fe	Al	Ca
rest	0.05	0.004	trace	trace	trace	trace	trace

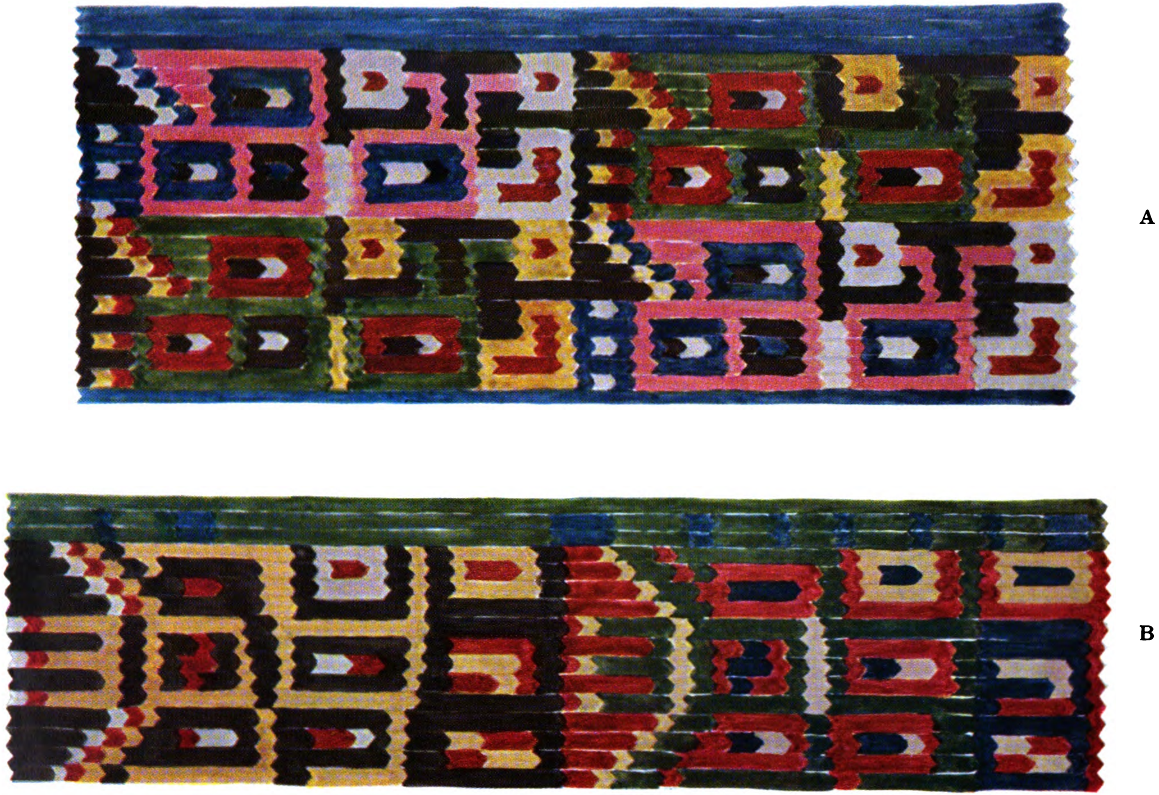
Hällefors, 7 April, 1971
(signed) Jan Fridberg

The *tupu* belonged as we know to the women's garments. Rowe (1946:235) summarizes the use as follows: "A large mantle, worn over the dress, was thrown over the shoulders and fastened on the chest with a large decorative metal pin (tupu)," adding that "these pins, made in a variety of sizes, are very common in archaeological collections." Montell (1929:235) believes that some with large disks very likely may have served as mirrors as well. Nordenskiöld (1906:38) and in the posthumous translation to Spanish (1953:89–91) raised the question as to in what proportion objects found in the chullpa graves are contemporaneous with the dead individuals buried in the graves, since evidently and according to Bandelier "the cloth with which all the corpses (ancient and modern) were covered, was periodically renewed, as late as the middle of the seventeenth century." Nordenskiöld drew the conclusion that the tupus, "los objetos más notables entre los

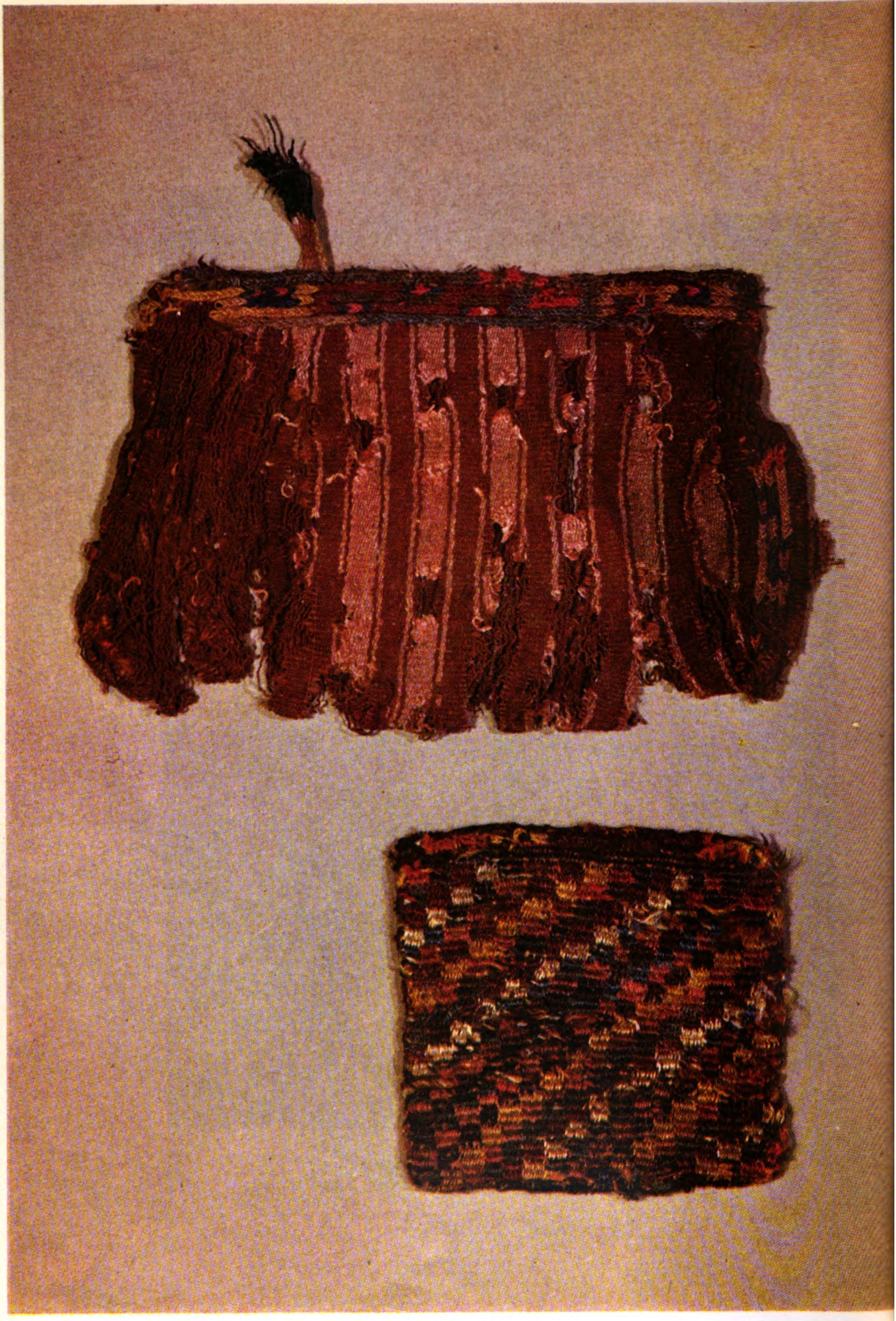
COLOUR PLATES



I. Motif of spittoon-shaped basket 70.19.50. See figs. 41–42. Drawing by Mrs. Margareta Anker.



II. *A*, Embroidery motif of bag 70.19.20a. *B*, Embroidery of bag 70.19.53. See fig. 52.
Drawing by Mrs. Margareta Anker.



III. *A*, Striped bag 70.19.58 a. See fig. 55. *B*, Bag in several colours, 70.19.22. Photographs by Sörvik, Göteborg.

exhumados de chullpas y que integran la vestimenta, son más o menos coatáneos con la colocación de los individuos fenecidos dentro de las casas y grutas funerarias" (Nordenskiöld 1953:90). Whether or not the tupu 70.19.18. originally belonged to the buried Niño Korin Indian, probably cannot, however, be decided. For Karsten's idea of tupus used as grave offerings I refer to the Introduction (p. 25).

CATEGORY J. *A human skull and a tuft of hair*

1. No. 70.19.48. Human skull. For a complete anatomical study of this skull, I refer to professor C. H. Hjortsjö's paper in this volume and its corresponding photographs.
2. No. 70.19.56a. A tuft of human hair (fig. 36). For this hair and the circumstances under which it was found in the woven ribbon 70.19.66, see Introduction (p. 26).

There is one important problem regarding the find of the skull that it has not been possible for me to elucidate, the question of whether the skull formed part of a skeleton or was found together with the other objects in the collection as part of the dead medicine man's outfit. If the skull belonged to a skeleton buried with all the specialized medicinal equipment, it would mean that the occupant of the grave, if a medicine man—a fact we have every reason to believe—had himself been trepanned when alive. As my informants, however, never mentioned the skull as part of a skeleton, there is reason to believe that the skull had been inserted in the grave as part of the medicine man's professional outfit. Under all circumstances the skull 70.19.48, has, as shown in professor Hjortsjö's paper, a high scientific value *per se*. For the C14 determination of the age of this skull I refer to pages 28, 145, and 192 in this volume.

CATEGORY K. *Baskets*

In the Introduction (p. 15) I referred to Bennett's statement (1946b:117) that baskets belong to the perishable material of which nothing is known from Classic Tiahuanaco. Rowe says about Inca basketry, cordage, and matting that "abundant material for study exists in tombs near Cuzco, a little of which has found its way into museums, but none of which has been studied. From superficial observation, it seems that the Inca made technically excellent baskets and mats, but took little trouble to decorate them, reserving their best efforts for textiles, pottery, metalwork, and wood" (Rowe, 1946:243). Here we have, in a find from a Tiahuanacoid culture no less than four excellently preserved baskets (Coll. Nos. 70.19.39, 49, 50, and 51 a–b), three of them decorated, the fourth with a lid. All this makes the find from Niño Korin scientifically still more interesting.

It has not been yet possible for me to have an examination made to determine the kinds of grasses used in these baskets, but for those used by the modern Aymara in their finest works I refer to La Barre (1948:102–103), as ordinarily the use of excellent fibers does not disappear even though techniques and ornamentation may change with the cultural changes. The technical descriptions quoted here have been written by Mrs. Margareta Anker of the Gothenburg Ethnographic Museum.

1. No. 70.19.39. Figs. 37–38. Coiled basket formed like a beaker. Height 10.2 cm., diam., rim 9.5 cm., base 6.7 cm. Colours: brown-black, red, straw-yellow.

Technical description: "There are 31 coiled rows round the basket. The foundation is a small bundle of 4–5 straws, sewn with a plant fiber (about 0.1 cm. broad), dyed in the different colours, forming rows which are 0.4–0.5 cm. high. The row round the rim is thinner than the others, while the lowest eight rows and the seven rows forming the bottom are thicker than the others. The sewing consists of wrapping the foundation three times or more with the fiber and then catching this under the turns of the coil below by means of stitches. These stitches are made three or more after each other, as often as needed to keep the rows in the fabric very tight. On the border of the rim, each wrapping round the foundation is fastened by means of a stitch into the row below." (M.A.).

The motif is highly conventionalized, perhaps a climbing figure carrying an axe (cf. the Classic Tiahuanaco masked warrior figure with battle axe and trophy head in Bennett, 1934, fig. 15c). It reminds us closely, however, of a motif found by Posnansky on a Tiahuanaco facade of stone and taken by him to be a "Wing" sign (see Posnansky, 1945–1958, vol. II, closeup in fig. 141 b), but most probably we see here a conventionalized full-face deity (cf. p. 36).

It is noteworthy that because of the technique used the basket appears with the same stylized figures both inside and outside.

2. No. 70.19.49. Figs. 39–40. Coiled basket formed like a beaker. Height 9 cm., diam. rim 8 cm., base 6 cm. Colours: brown-black, red, olive-green, straw-yellow.

Technical description: "There are 25 coiled rows round the basket. The row round the rim is thinner than the others, while the lowest eleven rows and the seven rows forming the bottom are thicker than the others. Round the base is one extra row fastened in five places, sewn after the basket was made, probably to make it stand steadily. The technique is the same as in basket 70.19.39." (M.A.).

This basket does not seem to have been used, and the decorative motifs appear with the same brightness both inside and outside.

The papers by Oyarzún (1930) and Latcham (1938) are of interest for some details, *e.g.*, for the beaker forms, annular foot, and the coiled technique. Rydén (1944:150 and fig. 84 A) has dealt with the annular foot woven in basketry as on the cup-shaped basket published by him from a find in the Rio Loa region. The author concludes that "outside the Atacama region I know of no basket of this type, . . ." Now one of the gaps has been filled, and we can undoubtly trace the origin of the occurrence of these baskets in the Atacama and Rio Loa regions to Tiahuanaco.

The ornamentation of basket 70.19.49 forms a series of triangular fields arranged in three sections round the basket.

3. No. 70.19.50. Fig. 41–42 and Plate I. Coiled basket. Height 8 cm., width diam. rim 15.5 cm., diam. base 13.5 cm. Colours: Brown-black, olive-green, straw-yellow. The base is circular, flat, with likewise flat sides. In analogy with the "flat-bottom spittoon-shaped bowls" observed in Early Tiahuanaco by Bennett and Bird (1960:171) this basket could be characterized as spittoon-shaped.

Technical description: "There are 23 coiled rows round the basket. The foundation is a small bundle of 4–5 straws, sewn with a plant fiber (about 0.1 cm. broad), dyed in the different colours and forming rows, 0.4–0.5 cm. high. The row round the rim is thinner than the others, while, the six lowest rows and the fifteen rows forming the bottom are thicker than the others. Of the baserows the middle three are red, the others straw-yellow coloured. Round the bottom an extra row was sewn on the basket after it was woven, probably to make it stand steadily. Only half of this row remains.

The sewing consists of wrapping the foundation 9–10 times with the sewing-fiber and then fastening the row thus formed with three or more stitches in the wrapping round the foundation on the row below. On the lowest rows there are three interlocking stitches between the wrappings round the foundation. In the middle rows there are four stitches, and, in the upper rows, five stitches to the row underneath. These interlocking stitches are repeated above the stitches underneath twentyfour times round the basket. On the border rim each wrapping of the foundation is fastened by a stitch to the row below." (M.A.).

The dominant repeated motif round the basket is a square head (or a compressed whole figure) with "crown", and "scepters" as depicted on the monolithic gateway at Tiahuanaco. We are fully entitled to consider this head as a representation of a full-face deity, identical with the representation of such a head and its iconographic details in the textile fragment published by William J. Conklin (see discussion on p. 35).

4. No. 70.19.51a–b. Fig. 43. Square coiled basket with lid. Height: basket (a) 14 cm., lid (b) 1 cm. Length: basket 15.5–16.5 cm., lid 16 cm. Width: basket 13.5–14 cm., lid 14–14.5 cm.

Nordenskiöld (1920, map 14) has an incomplete list of baskets with overlapping lids and baskets with lids "which are opened like an ordinary cigar-box." None of his examples refer to Highland Bolivia. The map was without the later additions, as the Chocó, etc., republished by O'Neale (1949:87). As a "classic example of covered baskets" she counts "the oblong twilled container with hinged lid commonly used in ancient Peru to hold a woman's weaving, spinning, sewing materials, and her small tools and spindles."

In the basket were found the objects catalogued as 70.19.52–60, and 64.

Technical description: "Wrapping: Three-ply grass- or plantfiber braid. Foundation: Round bundle of grass- or plant-fiber, forming about 0.4 cm. high rows. Coiled basketry technique with open sewing enclosing parts of the foundation, 0.2–0.4 cm. space between the wrapping.—In the middle of the lid there is a leather strap, 16 cm. long and 0.7 cm. broad, pulled through the fabric, with a knot on the inside and another knot 3.5 cm. from the end. Between the top-rows on the basket there are, on two adjoining sides, about 4 cm. from the corners, leather straps forming handles 14.5 cm. long, fastened in the same way as the strap on the lid, with a knot on the inside. On the opposite sides there have been handles too, but they are torn and the longest parts of the straps; those on the left side, are fastened together with knots; the shorter, loose ends are left hanging." (M.A.).

From the modern Aymara, Tschopik (1946:534) mentions coiled basketry "occasionally manufactured by women." These baskets have like this old one from Classic Tiahuanaco times, "a grassbundle foundation sewed with a fine, three-ply grass braid."

CATEGORY L. *Textiles*

The textiles found at Niño Korin consist of ribbons, textile fragments, and bags.

The strings belonging to the ribbon 70.19.10 and the bag 20a, are the only samples of cotton used in the whole textile part of the collection. The other material comes from animal fibers, according to the report from the Swedish Institute for Textile Research, TEFO, Göteborg (see p. 159).

For the following description the author owes the textile weaving analysis to Mrs. Margareta Anker of the Gothenburg Ethnographic Museum. Her analytical contributions will be signed M.A.

A. *Ribbons.* Nos. 70.19.10, 11, 55, 56, and 60. (Figs. 44–46).

1. No. 70.19.10. Fig. 44A. Blue ribbon. Length 50.7 cm., width 7.4 cm. Found wrapped round the objects 1–9 in the collection.

Fibers from this specimen were as sample 4 submitted to TEFO, Göteborg. See photos XII–XV in the report (p. 159). According to the report it is wool from either alpaca or llama, as the fibers from these two animals are nearly identical.

Technical description: "*Warp:* Two-ply, Z-S-spun, hard-twisted wool-yarn, 21/cm. *Weft:* Two-ply, Z-S-spun, loose-twisted wool-yarn, 9/cm. *Technique:* Repp (warpfaced). *Colour:* Dark-blue.

The ribbon has been cut off at both ends. One end is folded and the fold has been fastened with a Z-spun cord, made of four Z-S-spun, hard-twisted cotton-threads. The loose end of the cord measures 47 cm." (M.A.).

Bertonio (1879, 1:472) gives the Aymara name *quesña* for "yerua que sirve de teñir azul."

2. No. 70.19.11. Fig. 44B. Red ribbon. Length 50.8 cm., width 7.5 cm. Pattern in negative painting.

Fibers from this ribbon were as sample 3 submitted to TEFO, Göteborg, see photos VIII–IX in the report (p. 159). According to the report the material used should be fibers from alpaca plus vicuña.

Technical description: "*Warp:* Two-ply, Z-S-spun, hard-twisted wool-yarn, 28/cm. *Weft:* Two-ply, Z-S-spun, loose-twisted wool-yarn, 9/cm. *Technique:* Repp (warpfaced). *Colours:* Dark-yellow ground colour, painted with red in a geometrical pattern. The pattern has been achieved through negative painting, by covering the parts of the ribbon wanted yellow and brushing over with the red colour, which partly has soaked through the fabric and can be seen on the other side. The ribbon has been cut off at both ends." (M.A.).

3. No. 70.19.55. Fig. 45A. Red ribbon. Length 200 cm., width 4.3–5.5 cm. Found in the basket 51 a–b.

Technical description: "*Warp:* Two-ply, Z-S-spun, hard-twisted wool-yarn, 18/cm. *Weft:* Two-ply, Z-S-spun, loose-twisted wool-yarn, 7/cm. *Technique:* Repp (Warp-faced). *Colour:* Red.—The ribbon has been cut off at one end. At the other end there is a row of chain-stitches on each side of the ribbon, and 13 cm. of the warp-threads are left to form a fringe. This fringe is rather worn. On the worn parts of the ribbon the yarns are of light-brown colour indicating *that the ribbon was woven before it was dyed.*" (M.A.).

The latter observation, valid also for ribbon No. 56 (cf. the TEFO report, p. 171), is thus in contrast to Bandelier's statement (1910:233) that "the colors were given to the wool before it was spun." In this he has followed Cobo (quoted by Bandelier, p. 255: "La tinta dan á la lana y algodon en pelo, antes de hilarlo, y después de sacada del Telar la pieza no usan darle ninguna"). Rowe (1946:241) repeats that "the wool was always dyed before spinning according to Cobo." He also points out that "wool was used both in its natural colors and dyed with vegetable dyes, an enormous variety of which were used by the Highland Indians."

4. No. 70.19.56. Fig. 45B. Blue ribbon. Length 230 cm., width 7.5 cm. Found in the basket 51 a–b.

Technical description: "*Warp:* Two-ply, Z-S-spun, hard-twisted wool-yarn, 22/cm. *Weft:* Two-ply, Z-S-spun, loose-twisted wool-yarn, 8/cm. *Technique:* Repp (warp-faced). *Colour:* Blue-back.—The ribbon has been cut off at one end. At the other end are remains of a chain-stitch row and a fringe about 3 cm. long. At the same end as the fringe, there are two cords, about 8 cm. long, each made of eight very hard-twisted threads of two-ply, Z-S-spun wool-yarn. They are pulled through the fabric and fastened with knots, one cord at one edge of the ribbon and the other 2 cm. from the other edge. Where the ribbon is much worn, the yarns show a grey-white colour, indicating that the ribbon *was woven before it was dyed.*" (M.A.)

The latter statement has been confirmed by research-engineer Helge Hjalmarsson, TEFO, Göteborg, in his report published in this volume (p. 171). He has also found the material to consist of animal fibers. Well concealed in this ribbon was found the human hair described as 56 a (p. 49).

5. No. 70.19.60. Fig. 46. Ribbon. Length 64 cm., width about 5.5 cm. Found in the basket 51 a–b.

Technical description: "*Warp:* Two-ply Z-S-spun, hard-twisted wool-yarn, 22/cm. *Weft:* Two-ply Z-S-spun, hard-twisted wool-yarn, 7/cm. *Technique:* Repp (warp-faced). *Colours:* Warp: blue, red, light-yellow, yellow, light-brown. Weft: dark-brown.—One end of the ribbon is the warp selvage, the other end is torn off. The ribbon is striped (warp-effect), one half of it in darker colours than the other. Two of the stripes are broader, on which vertical stripes alternate with irregular-appearing squares and staircase pattern." (M.A.).

Mrs. Margareta Anker has also produced the following warp-order for the ribbon 70.19.60:

blue	red	blue	light brown	blue + dark brown	light brown	blue	red	blue	light yellow	blue	brown + yellow	blue	light yellow	red	blue
18	9	3	5	10+10	5	4	8	9	4	4	10+10	4	4	7	18

We may guess that the ribbons (from about 50 cm. to 230 cm. in length) were used for applying a bandage during an act of trepanning.

B. *Textile fragment*

No. 70.19.59. Fig. 47. Length about 52 cm., width about 20 cm. Found in basket 70.19.51 a–b.

Technical description: "*Warp:* Two-ply Z-S-spun, hard-twisted wool-yarn, 24/cm. *Weft:* Two-ply Z-S-spun, more loosely twisted wool-yarn, 6/cm. *Technique:* Repp (warp-faced). *Colours*, warp: blue, yellow, red, green, gray-white; weft: dark-brown. The fabric is striped (warp-effect). On three of the stripes vertical stripes alternate with squares and other forms, not possible to distinguish because of the bad and damaged condition of the fabric.

The fabric has been folded, from selvage to selvage, in about 1 cm. broad folds. The edges of the folds are very worn.

There are remains of two loop-stitch rows along the selvage, made with two-ply, Z-S-spun, hard-twisted wool-yarn. Colours of the embroideries: white, red, green, blue, dark-brown." (M.A.).

C. *Bags or bag-like pouches*

To this collection belong no less than six textile bags (Nos. 70.19.20 a, 22, 52 a, 53, 54, and 58 a). Of these no less than three, namely 20 a, 52 a, and 58 a, contained leaves of *Ilex Guayusa*. All of them have been technically analyzed by Mrs. Margareta Anker of the Gothenburg Ethnographical Museum, and in the following her descriptions for each of the bags have been signed M.A. No fewer than four of the bags were found in the basket with lid (No. 51 a–b).

1. No. 70.19.20a. *Woven bag with embroideries.* Height 13.5 cm., width 18–20 cm. Fig. 48 and plate II A. For leaves of *Ilex Guayusa* (70.19.20 b) found in this bag, see p. 61.

Technical description: "*Warp:* Two-ply Z-S-spun, hard-twisted wool-yarn, 27/cm. *Weft:* Two-ply, Z-S-spun, loose-twisted wool-yarn, 10/cm. *Technique:* Repp (warp-faced). *Colour:* Brown.

There are 11 rows of vertical-loop-stitch embroideries along the sides and 22 round the opening, sewn after the fabric (woven in one piece) was folded and sewn together. The finishing row is sewn on the inside of the rim. For the embroidery technique (fig. 49) see d'Harcourt's loop-stitch embroidery executed in vertical lines (1962:123, fig. 90 C–D, and pl. 81 C,D). The embroideries are made with two-ply, Z-S-spun, hard-twisted wool-yarn in gray-white, yellow, rose, red, dark-blue, olive-green and gray-black.

On one side of the bag there are remains of a cord, made of five two-ply, Z-S-spun, hard-twisted cotton fibers. It is tied with a knot round the edge of the bag, 3.5 cm. from the right side." (M.A.).

Samples of the fibers in the bag (sample 1) and its embroderies (sample 2) have been submitted for analysis to the Swedish Institute for Textile Research, Göteborg. The report (p. 159) indicates that the fibers in the bag (TEFO-photos I–IV) are hair from alpaca and that the embroidery fibers (TEFO-photos V–VII) are alpaca plus vicuña.

The cottom cord mentioned above together with the cord on the ribbon 70.19.10 are the only samples of cotton used in the textiles from Niño Korin described in this work. Cotton is also today less frequently used in the Highlands (see Goodell, 1968:3).

For the bird motif in the embroidery I refer to the illustrations, in plate II. The bags 20a and 53 have both a condor with outstretched wings and a "crown" in the embroidered motifs. In the bag 20a this motif is repeated in two different sets of colour, and this is also true for the bag 70.19.53.

During the beginning of my research, I asked two expert colleagues to give their opinions on the embroidered bag 70.19.20a. Dr. Junius B. Bird, of the American Museum of Natural History, who wrote to me on October 5, 1970, said that "in Paracas Necropolis fabrics, one finds many with the same stitch, used to cover the seams where fringes are sewn to mantles and other garments. While visibly similar to your specimen, it is different and I have never seen your type used on Paracas fabrics. It does occur commonly on late Nazca fabrics, which I believe antedate the appearance of Wari-Tiahuanaco style influence in that area by a relatively brief time." Dr. Bird further refers to three embroidered textiles found in the upper half of the Black Refuse deposit at Punta Pichalo, Chile (in the AMNH collections) and continues: "In all instances of the Chilean and the Nazca specimens, the embroidery is used to create bands bordering or framing plain areas, as it does on your pouch. I do not recall ever seeing any examples of this work on any central coast specimens, nor on any from further north."

Mrs. Jane Powell Dwyer, Curator, Ethnic Arts, M.H. De Young Memorial Museum, San Francisco, California, answered in a letter of March 7, 1971: "I have been examining your drawing of the Tiahuanaco embroidered bag and have concluded that although there are some general features which could relate the design to Paracas, I do not recognize much in the highly schematized Paracas examples. The arrangements and orientation of the figures are not characteristic of Paracas. The eye composed of a black and white segment is also different. The same eye-like form occurring on the bird's body is not found in Paracas although it does appear similar to Nazca usage. The beak of the bird is also unusual. On the other hand, there are some points of very general resemblance. The white ruff around the bird's neck may indicate that the bird depicted is a condor, which, as a motif, is very significant in Paracas textiles, and as far as I know is not too prominent in sierra iconography. The appendages (?) on the head are curious and although they are completely different in shape from those of Paracas the latter might have been the source of inspiration for such a form."

2. No. 70.19.22. *Bag in several colours*. Height 9 cm., width 9.5 cm. Plate IIIB.

Technical description. "*Colours:* Blue, white, rose, yellow, green, red-brown, and dark-gray. *Technique:* The bag is coiled with two-ply, Z-S-spun, rather unevenly spun and twisted wool-yarn. It is sewn together at the bottom with dark-blue Z-S-spun wool-yarn. Round the rim there are remains of one vertical-loop-stitch row, sewn with red and yellow two-ply Z-S-spun hard-twisted wool-yarn. There are 37 coiled rows round the bag.

The pattern is made by wrapping the foundation with one colour, four to eight times (about 0.5 cm), the next colour about 0.5 cm., and so on.

The same colours are repeated on the second row, but on the third (the fifth, the seventh, etc.) the colours are shifted to the right, thus forming a diagonal pattern of squares.

The wrapping is very uneven and the colours are not repeated in any other fixed order than in the diagonal squares. Almost every wrapping is fastened with a stitch to the wrapping below. When one colour part is finished, the yarn is put inside the wrapping of the following colour, and in that way the foundation of wool-yarn in several colours is formed." (M.A.).

Latcham (1938:300, fig. 127) has published a "tela de bolsa" from the Atacama region which reminds us of the specimen from Niño Korin. He describes it shortly (p. 284) as a "bolsa de tamaño mediano, tejida a cuadritos y rectángulos de diversos colores como el rojo obscuro, rojo vivo, azul, amarillo, etc."

3. No. 70.19.52a. *Light-brown woven bag.* Height 17 cm., width 21 cm. Figs. 50–51. For leaves of *Ilex Guayusa* (70.19.52b) see p. 61. Found in the basket 70.19.51a–b.

Technical description: "*Warp:* Two-ply Z-S-spun, hard-twisted wool-yarn, 34/cm. *Weft:* Two-ply Z-S-spun, loose-twisted wool-yarn, 10/cm. *Technique:* Repp (warp-faced).—There are remains of three rows of vertical-loop-stitch embroideries along the sides and round the rim, made after the fabric (woven in one piece) was folded and sewn together with dark-brown, Z-S-spun wool-yarn. The embroideries are made in blue, red, green, yellow and dark-brown. At the rim, on one side of the bag, there is a cord, 11.5 cm. long, pulled through the fabric and fastened with a knot on the inside. The cord is Z-twisted, made of six two-ply Z-S-spun, hard-twisted wool-yarns, three blue, one light-brown, and two green." (M.A.).

4. No. 70.19.53. *Light-brown woven bag with embroideries.* Height 14.5 cm., width 21 cm. Found in basket 70.19.51a–b. Motif: Outstretched flying bird (condor), see fig. 52, and plate II B.

Technical description: "*Warp:* Two-ply, Z-S-spun, hard-twisted wool-yarn, 36/cm. *Weft:* Two-ply, Z-S-spun loose-twisted wool-yarn, 10/cm. *Technique:* Repp (warp-faced). There are five rows of vertical-loop-stitch embroideries along the sides, and sixteen round the rim, made after the fabric (woven in one piece) was folded and sewn together. The finishing row is sewn on the inside of the rim. The embroideries are made in two-ply, Z-S-spun, hard-twisted wool-yarn in blue, red, white, green, yellow and gray-black." (M.A.).

5. No. 70.19.54. *Network bag.* Fig. 53. Height about 16.5 cm., width at the opening 16–17 cm.

Technical description: "Network made with square knot, see fig. 54, after d'Harcourt (1962, fig. 76 A–B, p. 107). *Yarn:* Two-ply, S-Z-spun, hard-twisted wool of undyed fibers in several colours, from black to light yellow, spun together without any fixed order.

The bag is shaped like a wide beaker. There is a hole, 2 cm. in diam., in the bottom, where the yarn-ring holding the beginning of the netting, is missing. At the rim, there are remains of a border of horizontal-loop-stitches, made of the same yarn as the bag." (M.A.).

Mrs. Margareta Anker has during her work with the textile material in the Niño Korin collection observed that this netbag is the only textile specimen in the collection where we find S-Z-spun yarn, as all the other textile specimens have been made with Z-S-spun yarn. This observation has been confirmed by research-engineer Helge Hjalmarsson of TEFO, Göteborg (see p. 171). According to him, the yarn consists of two-plied S singles doubled with a Z, and the yarn has darker and lighter components and consists of variously sized fibers of animal origin.

This is all most interesting in light of the fact that Bertonio (1879,1:315) already has cited the Aymara terms *mithathapitha*, *mithatha* for "mesclar vna lana con otra." Frödin and Nordenskiöld (1918, map 4) squaremarked the Aymara (number 86 on the map) for "teils rechts-, teils linkgesponnen" (for one thing clock-wise, S-twist, for another thing counter-clockwise, Z-twist). Regarding the direction of the spin or twist of the yarn, or the change of the direction, a reference should here be made to Goodell's fascinating study of the modern Indian spinning in the Cuzco region. In her study she points out that many distinctions govern the twist of the yarn. "These are based on faith in the magical properties of yarn spun 'clockwise' (with an S twist), called *lloq'e,* in contrast to the normal every-day product made with a Z twist. The Quechua word *lloq'e* means left and also 'something different'. In this case it would mean 'the left-spun yarn.' In almost every Indian community visited, including villages on the main valley roads, some superstitions about *lloq'e* yarn still survive; everywhere in the mountains the medicinal and religious lore employing *lloq'e* is rich, diverse and very strong. *Sometimes only brujos (medicine men) can spin lloq'e,* . . ." Goodell, 1968:7). The italics in the last part of the quotation are mine, as the network bag was found in a medicine man's grave.

For the question of S and/or Z twist yarns a reference should also be made to Bennett and Bird (1960:264). According to these authors, "sometimes S and Z twist yarns are combined in a single fabric, perhaps intentionally."

Regarding the blending of fibers as we have found them in the network bag, I also quote Miss Goodell (1968:4) as she points out that "wool, llama or alpaca yarns will commonly be combined in a single woven product, yet, if the fibers are ever blended or combined in a single yarn, this must be rare."

6. No. 70.19.58a. *Striped bag.* Height 10 cm., width about 14 cm. Fig. 55 and plate IIIA. Found in the basket with lid, 70.19.51a–b. For leaves of *Ilex Guayusa* (70.19.52b) found in this bag, see p. 61. The bag was found turned inside out (fig. 55).

Technical description: "*Warp:* Two-ply Z-S-spun, hard-twisted wool-yarn, 34/cm. *Warp:* Two-ply Z-S-spun loose-twisted wool-yarn, 10/cm. *Technique:* Repp (warp-faced). *Colours*, warp: brown beige and rose, spun together; weft: One side and half of the other brown, the other half beige.

The bag is striped in two colours. It is badly damaged, in some parts the warp-yarns are hanging loose with no weft left, and there are square holes on both sides.

There are remains of seven rows of vertical-loop-stitch embroideries round the rim, and three along the sides, made after the fabric (woven in one piece) was folded and sewn together. The finishing row is sewn on the inside of the rim.

The embroideries are made of two-ply Z-S-spun, hard-twisted wool-yarn in rose, green, blue, dark-blue, brown, white and yellow. At the edge of the bag, four cm. from one side, there is a ribbon woven with the warp-yarns fastened, on the bag, after the embroideries were made. The ribbon is 0.9 cm. broad and 5.6 cm. long. It is white to a length of 2.3 cm. nearest the edge of the bag, the rest of the ribbon, which is torn at the end, is blue. The yarn in the ribbon, Z-S-spun, hard-twisted wool-yarn, is coarser than the yarn in the bag. Warp: 18/cm., weft: 6/cm. The weft is dark-brown in the blue part and white in the white part." (M.A.).

Mrs. M. Anker has also drawn the following warp-order for the striped bag 70.19.58a.

	brown	beige	brown	beige	brown	beige		brown
8 ×	22	4	4	22	4	4	+	22

During her technical work with bag-like pouches, Mrs. M. Anker drew some conclusions which she summarizes as follows: "In the bag 70.19.20a the wool is a shade darker than that in the bags 70.19.52a and 53.

The motifs of the embroideries are different in all the woven bags, but the technique in weaving, embroidery as well as material is equal. The warp thread count can vary about two threads per cm.

In the striped bag 70.19.58a the yarn in the weft is the same as in bag 20a, and the warp thread count the same as in bag 52a.

The weft thread count is the same in the four bags, ten threads per cm. It is therefore possible that these specimens have been woven by the same person."

CATEGORY M. *Leaves*

A. *Material found in bags*

As already mentioned for the bags 70.19.20a, 52a, and 58a in the preceeding Category L, bunches of *Ilex Guayusa* leaves were found in these bags. For these bunches of leaves (Nos. 70.19.20b, 52b, and 58b) I here refer only to the illustrations in figs. 50, 55, 56, and 57, and the special contributions by Schultes, Holmstedt and Lindgren in this volume. For the results obtained when two portions of these leaves as well as those found in the *Duroia* cover (see below) were submitted to radiocarbon dating, I refer to my *Introduction*, p. 29 and to Dr. Hultin's contribution to this volume (p. 185).

B. *Duroia and Ilex Guayusa leaves*. No. 70.19.41–47. Figs. 58–60.

In the Niño Korin material was found a hard-dried and shriveled "ball" of a leaf, which unfortunately did not get photographed before it was opened to determine whether or not it contained something. When Professor Gunnar Harling of the Institution for Systematic Botany of Gothenburg University succeeded in steaming and opening the "ball" (big as a large fist), several leaves of *Ilex Guayusa* were found in it. Some of the leaves were given to the collections of the Botanical Museum in Göteborg, others to professor Bo Holmstedt of the Karolinska Institutet, Stockholm, for his special research on the material. The remaining leaves from the shrunken package now have coll. numbers 70.19.42–47 (see fig. 58–59).

Regarding the big covering leaf (70.19.41), measuring 17×52 cm., it later was possible for Dr. Benkt Sparre of the Department of Botany of the Swedish Natural History Museum at Stockholm to identify it as *Duroia* aff. *saccifera*, of the Rubiaceae. A comparative picture of such a leaf from a botanical collection is seen in fig. 60.

FIGURES

Abbreviations:

GEM. = Göteborgs Etnografiska Museum.
M.A. = Mrs. Margareta Anker, GEM.
G.H. = Mr. Gunnar Hedman, GEM.
T.I. = Mr. Tage Ingvar Johansson, Göteborg.
B.T. = Mr. Björn Thörnborg, GEM.

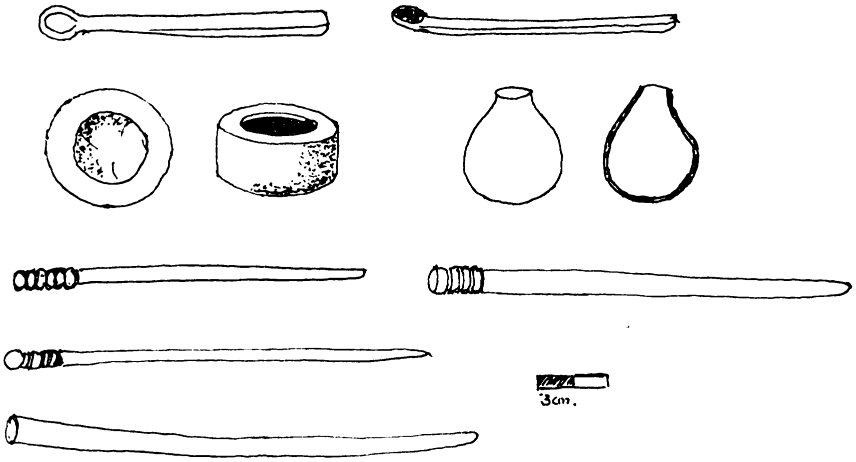


Fig. 1. Archaeological objects from the region of Niño Korin, now in the *Museo Tiaguanacu*, La Paz. After Oblitas Poblete 1963. Drawing G.H.

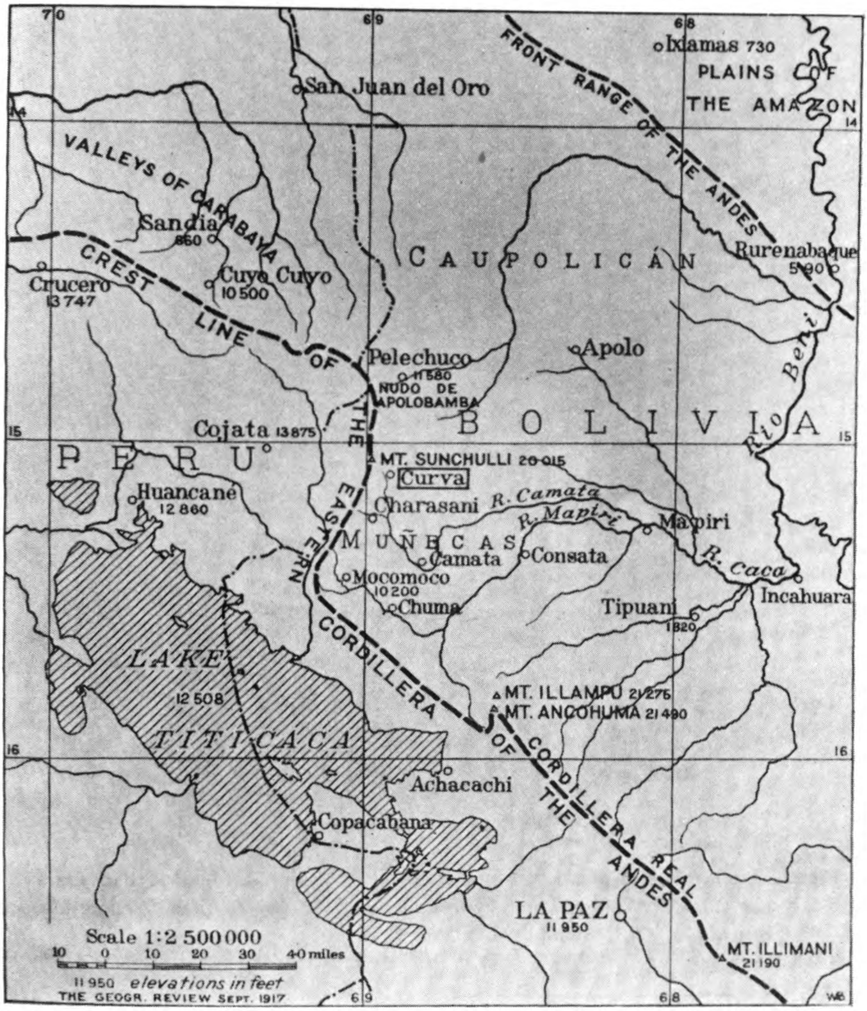


Fig. 2. Map showing location of Curva. After Wrigley 1917. Courtesy by The Geographical Review, American Geographical Society, New York.

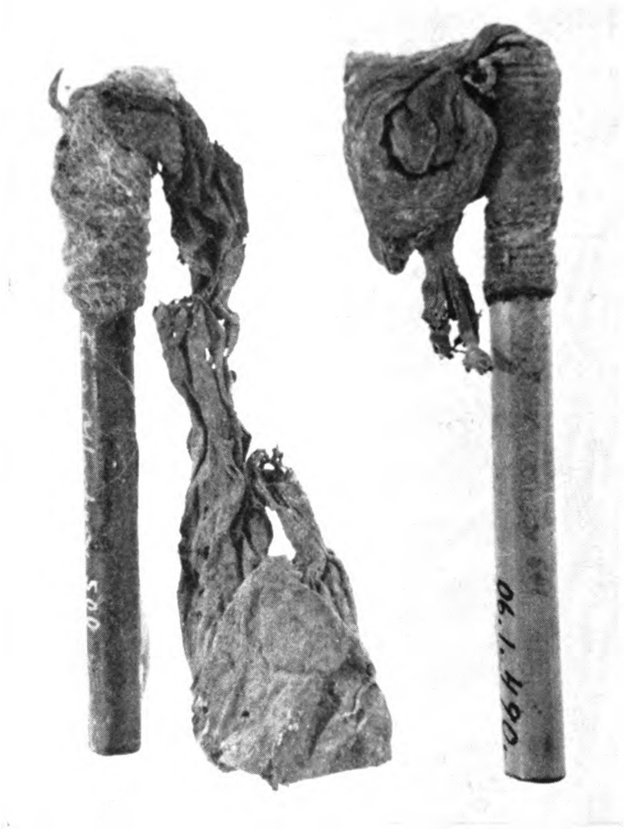


Fig. 3. Archaeological enema syringes found by Erland Nordenskiöld in a grave in the Ollachea Valley, Peru. Length of tubes 6 cm. Coll. Ethnographic Museum, Stockholm, 06.1.489 and 490. Photo B.T.

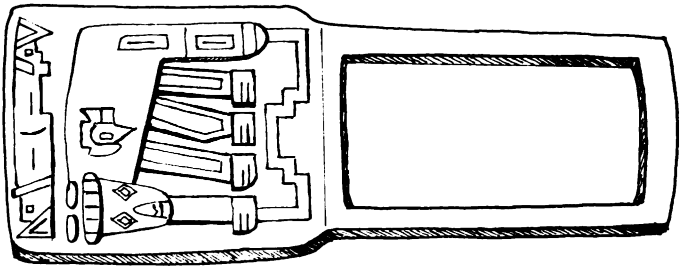


Fig. 4. Snuff tablet from the region of Niño Korin, now in the *Museo Tiaguanacu*, La Paz. After Oblitas Poblete, 1963. Drawing G.H.

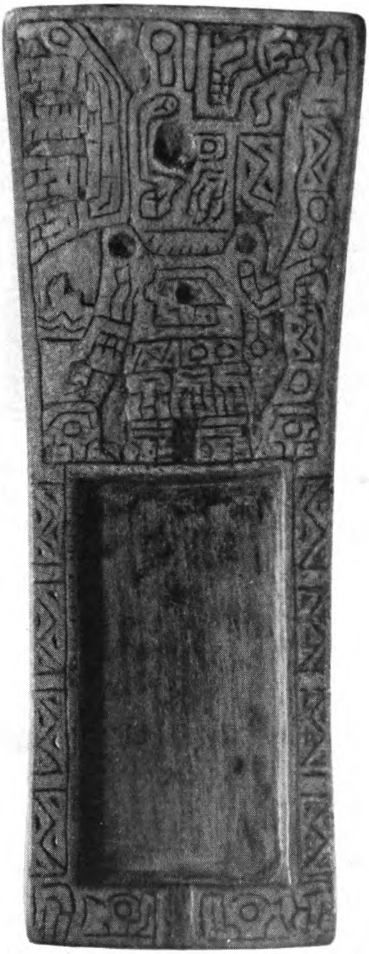


Fig. 5. Wooden snuff tray from Niño Korin. L. 18.5 cm. Coll. 70.19.1. Photo B.T.

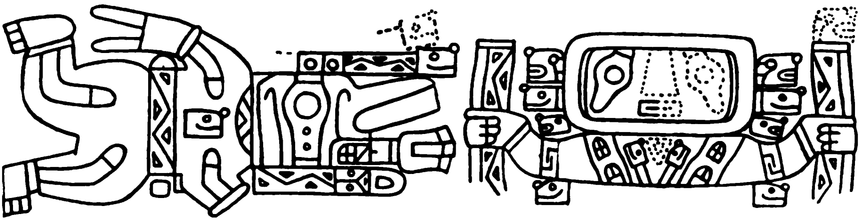


Fig. 6. Detail of design in the Tiahuanaco style of a deity figure in Staff God pose and one of the floating angels. From the incised design on the edge of the Calle Linares lintel, La Paz. After Posnansky, 1945–58, vol. II: Fig. 140a, and Rowe, 1971, fig. 23, p. 117.

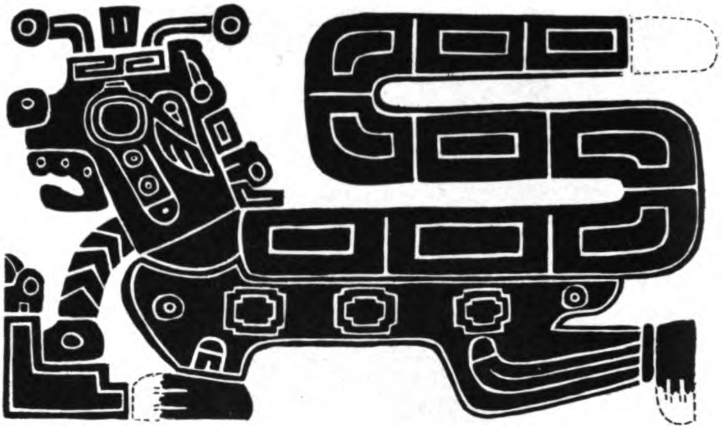


Fig. 7. *A.* One of two opposed jaguar figures in Tiahuanaco style on a block of stone found in S. Pedro de Tiquina, Bolivia. Length of the animal in low relief sculpture 27.5 cm. Coll. GEM. 44.12.21. After Göteborgs Museum, Årstryck 1945.

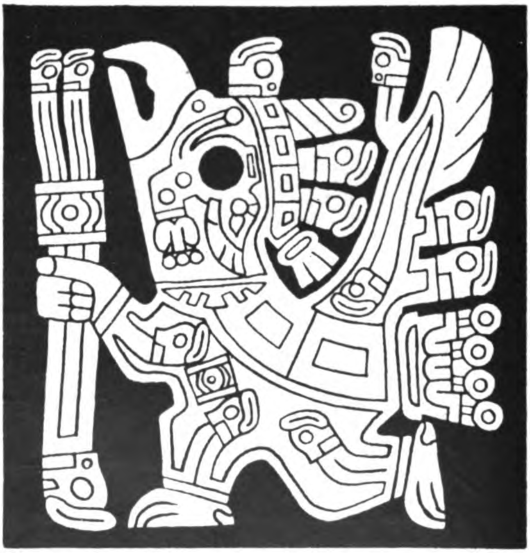


Fig. 7. *B.* Falcon-headed, staff-bearing figure with wings from the "Gateway of the Sun" at Tiahuanaco. After Sawyer, 1963.

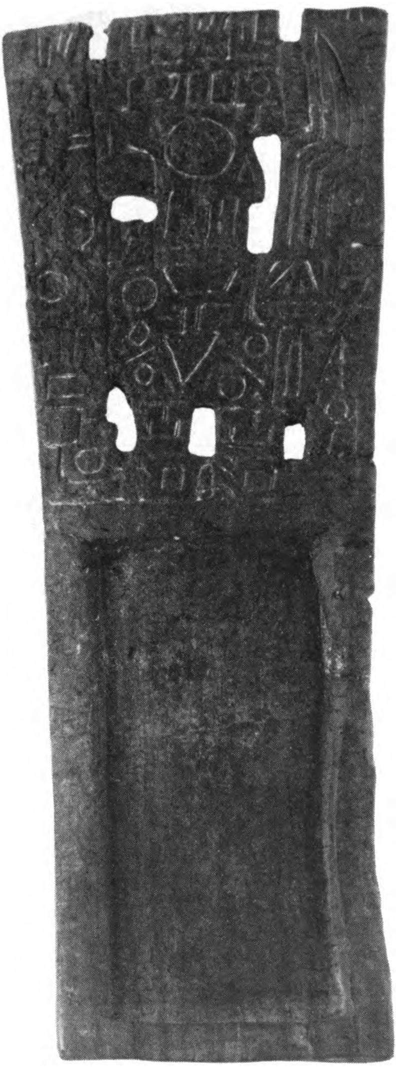


Fig. 8. Snuff tray of wood from Niño Korin. L. 16 cm. Coll. 70.19.19. Major details chalked for photography purposes. Photo B.T.

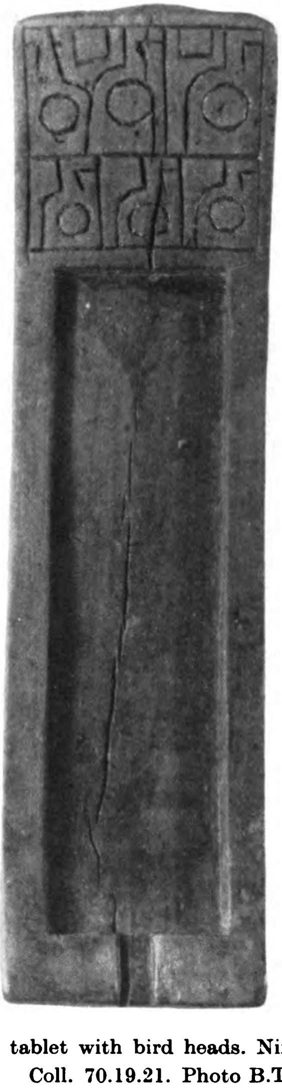


Fig. 9. Wooden snuff tablet with bird heads. Niño Korin. L. 14 cm. Coll. 70.19.21. Photo B.T.

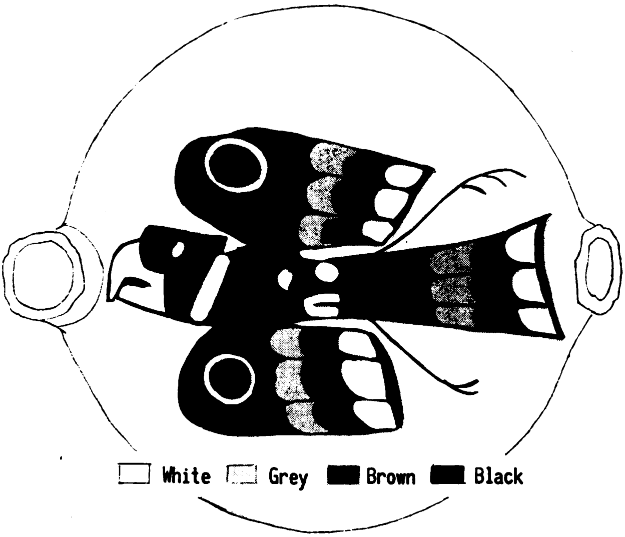


Fig. 10. Painted motif on a pottery vessel from Tiahuanaco. 1:2. Coll. GEM. 28.3.23. Drawing M.A.

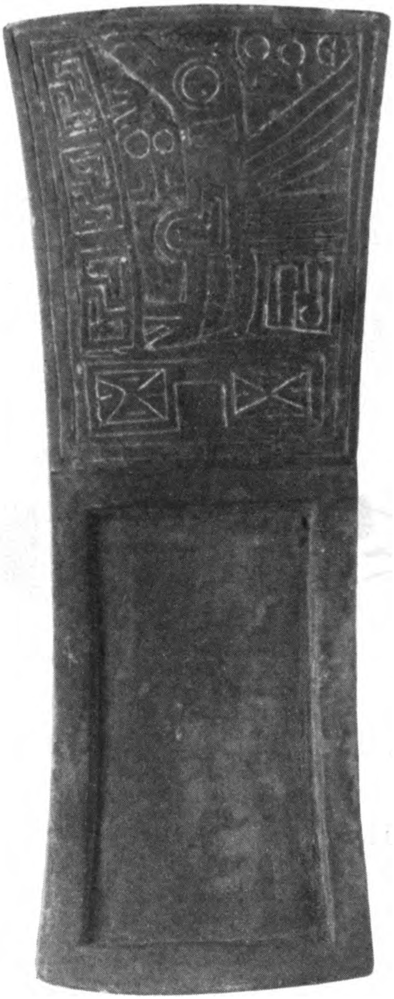


Fig. 11. Snuff tablet of wood. Niño Korin. L. 17 cm. Coll. 70.19.23. Details chalked for photography purposes. Photo B.T.

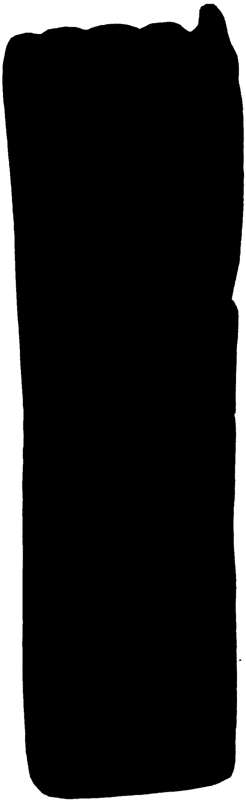


Fig. 12. Snuff tablet of soft wood in the form of a fist. Niño Korin. L. 10.5 cm. Coll. 70.19.33. Photo Sörvik.

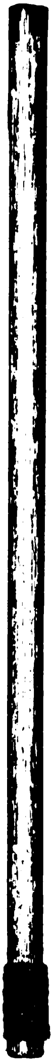


Fig. 13. Bamboo tube. Niño Korin. L. 24.5 cm. Coll. 70.19.3. Drawing G.H.

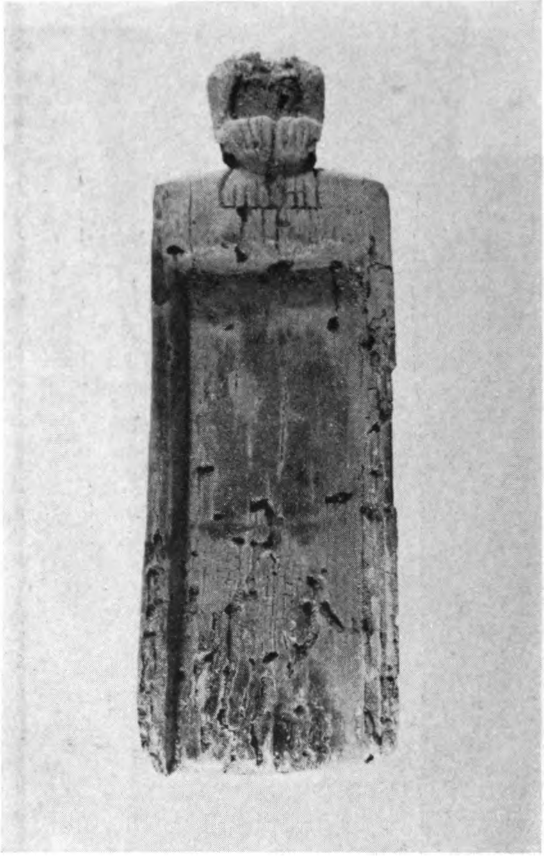


Fig. 14. Wooden snuff tablet from Puerto Nuevo de Paracas, Peru. L. 13.5 cm. Courtesy by the *Instituto de Antropología y Agricultura Precolombina*, Lima. Coll. No. B.260.

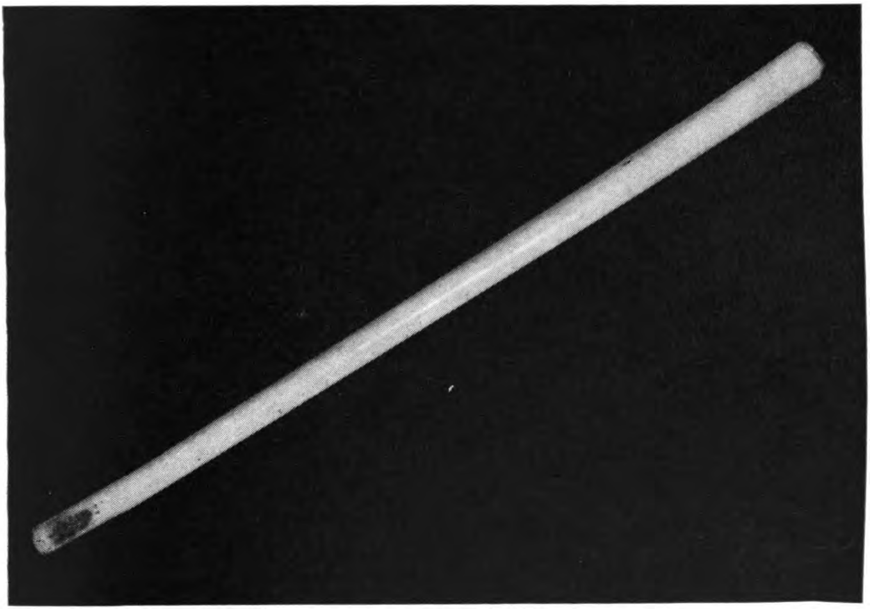


Fig. 15. Bone tube, length 24 cm., from a pre-Chavin shell mound in Asia, Omas basin, central coast of Peru. Courtesy by the *Instituto de Antropologia y Agricultura Precolombina*, Lima. Coll. No. B.768.

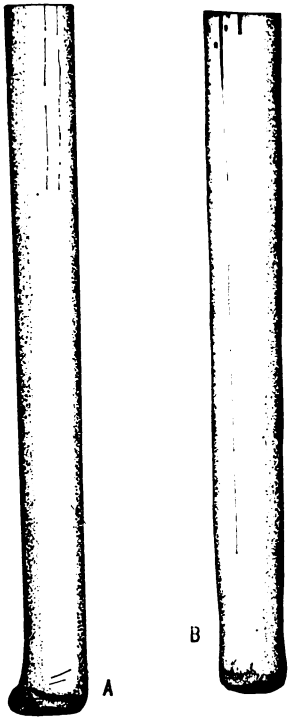


Fig. 16. Bamboo tubes, Niño Korin. *A*, Coll. 70.19.13a, length 18.8 cm. *B*, Coll. 70.19.2a, length 17.7 mc. Drawing G.H.

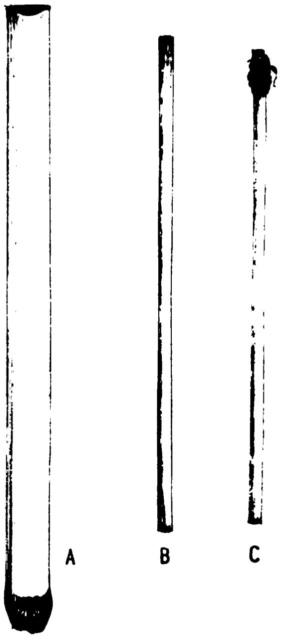


Fig. 17. *A*, Bamboo tube from Niño Korin, length 16.5 cm. Found with two reeds, *B*, length 13 cm. and *C*, length 12.5 cm. Drawing G.H.

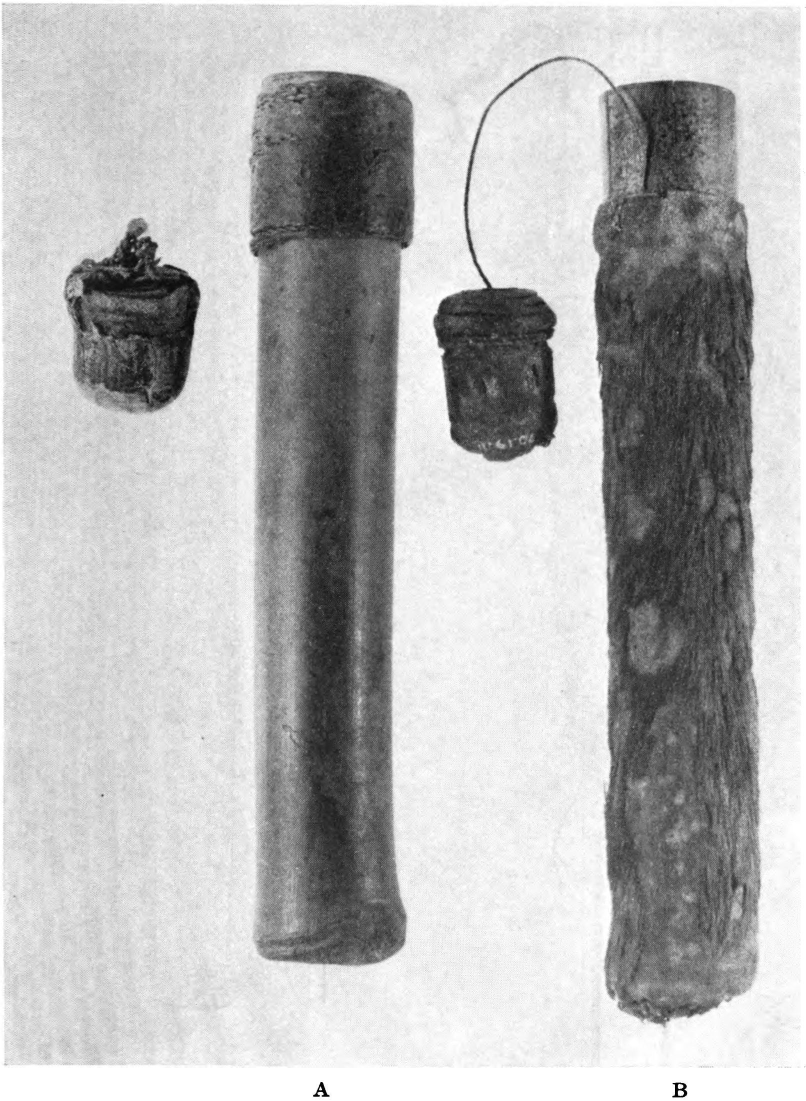


Fig. 18. Bamboo tubes with stoppers, Niño Korin. *A*, Coll. 70.19.14a–b, length 18 cm., *B*, Coll. 70.19.16a–b, length 17.7 cm. Photo B.T.

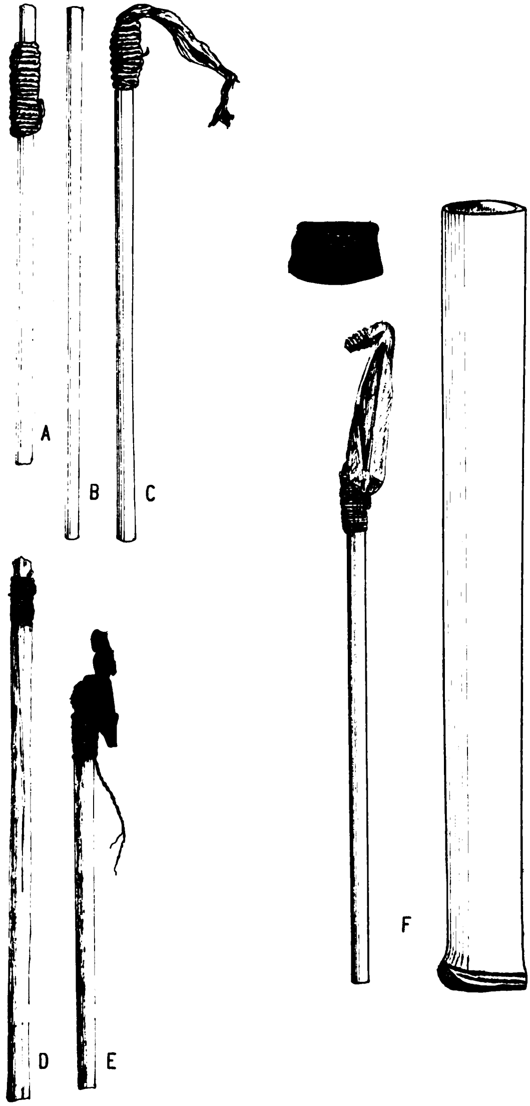


Fig. 19. *A–B*, Reeds, 12 and 14 cm. in length. Coll. 70.19.26 and 25. *C* and *E*, supposed enema syringes with dried bulbs, length 14 and 12 cm. Coll. 70.19.27 and 7. *D*, Reed, length 14 cm., Coll. 70.19.6. *F*, Bamboo tube with lid, Coll. 70.19.15a–b, length 21 cm. The complete enema syringe, Coll. 70.19.15c, seen in the figure, was found in this tube. Length of its reed shaft 13.5 cm. All specimens Niño Korin. Drawing G.H.

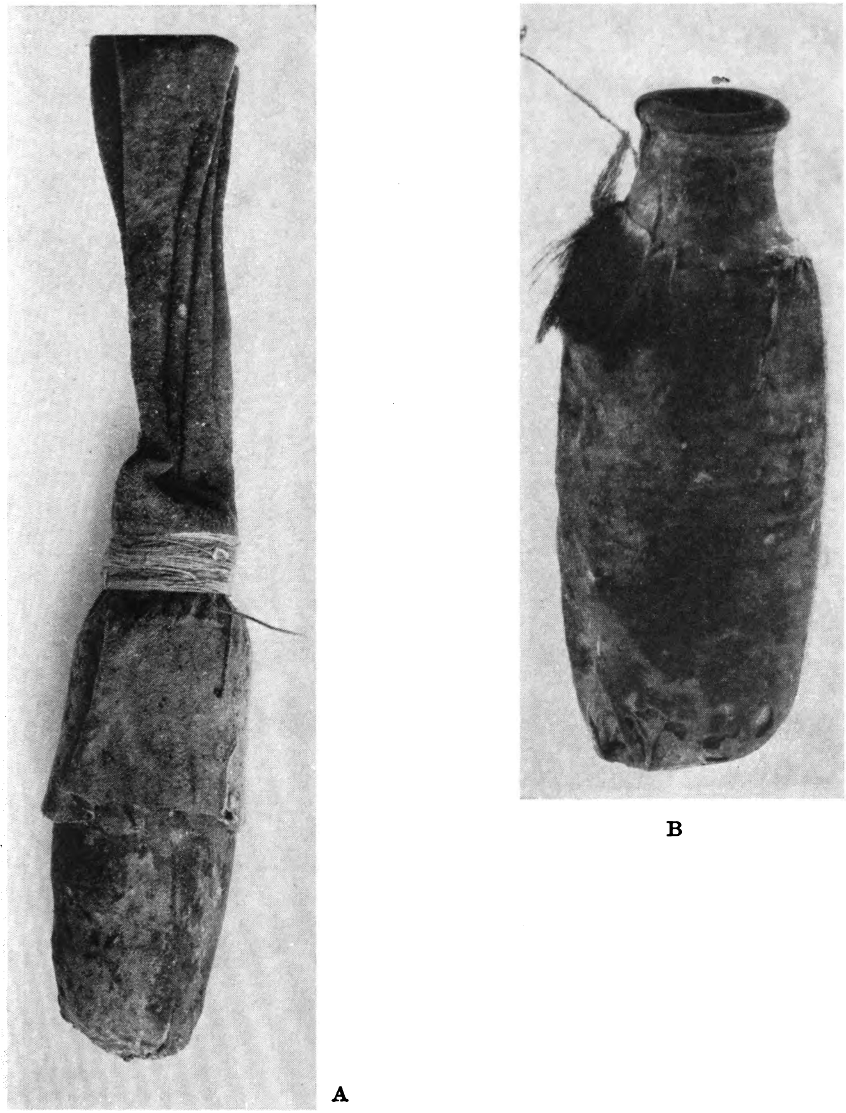


Fig. 20. *A–B*, skin-covered bottle-shaped container of a lecithydaceous fruit, *Cariniana decandra* Ducke. Length of the fruit container 10.5 cm., the protecting cover of soft skin 15.5 cm. Niño Korin. Coll. 70.19.31a–b. Photo *A:* Karolinska Institutet, Stockholm. Photo *B:* B.T.

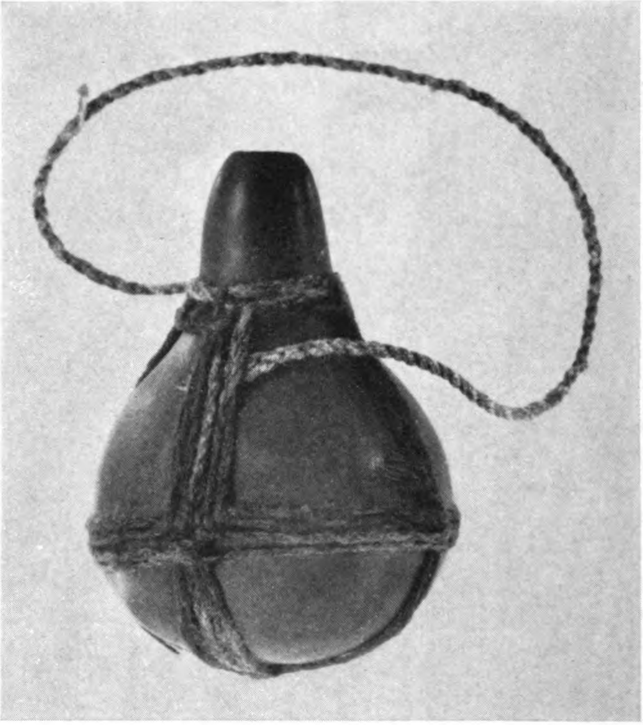


Fig. 21. Container of *Lagenaria vulgaris*, h. 7 cm. Niño Korin. Coll. 70.19.32
Photo B.T.

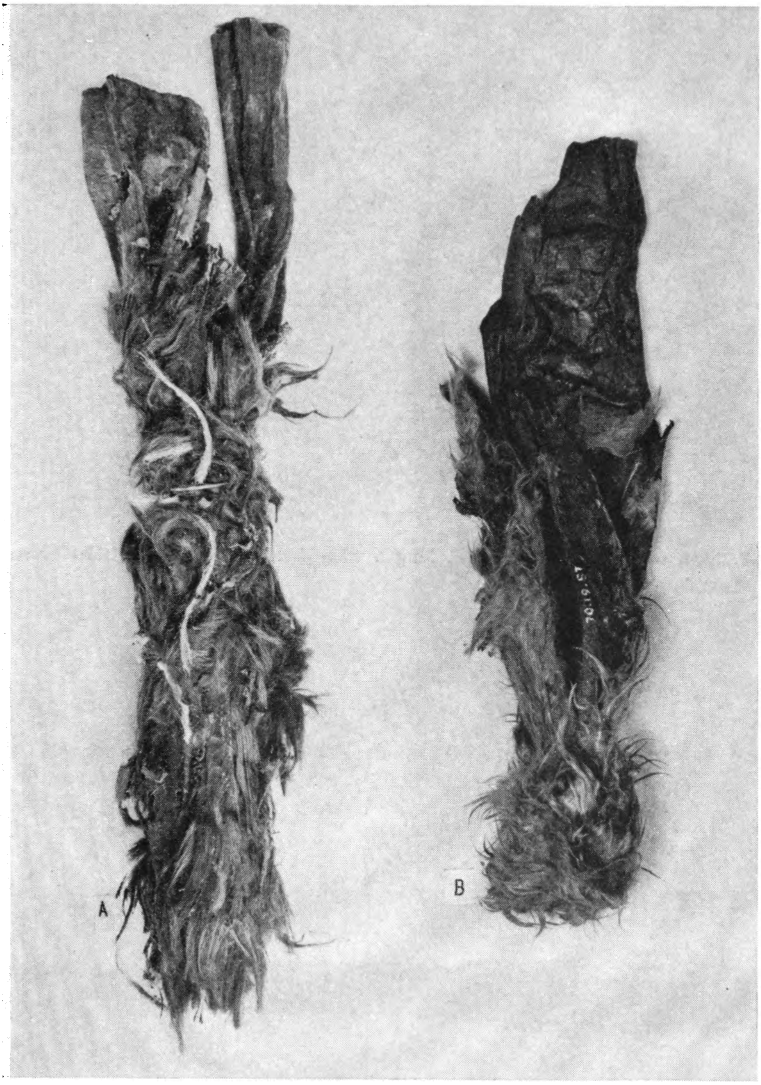


Fig. 22. Fur pouches. *A*, Coll. 70.19.8a, length 20.5 cm. *B*, Coll. 70.19.57, length 24 cm. Niño Korin. *A*, Photo Karolinska Institutet, Stockholm. *B*, Photo Sörvik.

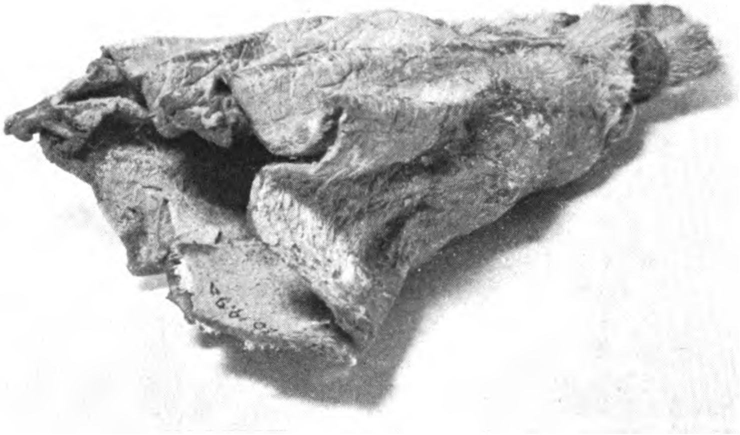


Fig. 23. Skin pouch, Coll. 70.19.9a, length 17.5 cm. Niño Korin. Photo Karolinska Institutet, Stockholm.

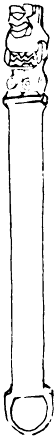


Fig. 24. Spatula of stone belonging to a snuff tray of the same material, originally published by Posnansky. Tiahuanaco. Coll. *Museo Etnográfico, Buenos Aires.* After a photo in the Gothenburg Ethnographical Museum. Drawing G.H.

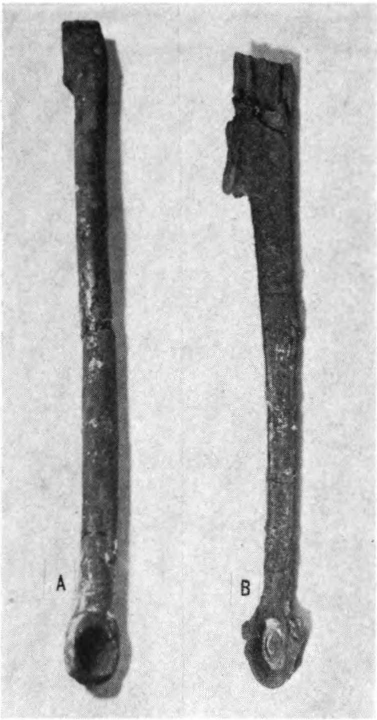


Fig. 25. Wooden spatulas from Niño Korin. *A*, Coll. 70.19.40, L. 14.3 cm. *B*, Coll. 70.19.24, L. 11 cm. Photo B.T.

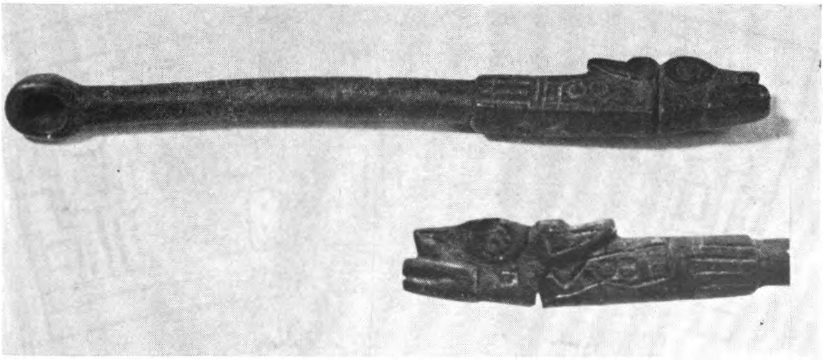


Fig. 26. Spatula of wood with *boga* fish handle. Niño Korin. Coll. 70.19.29. L. 11.5 cm. Photo B.T.

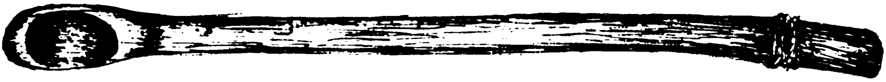


Fig. 27. Spatula of brown wood. Niño Korin. Coll. 70.19.36. L. 11.8 cm. Drawing G.H.

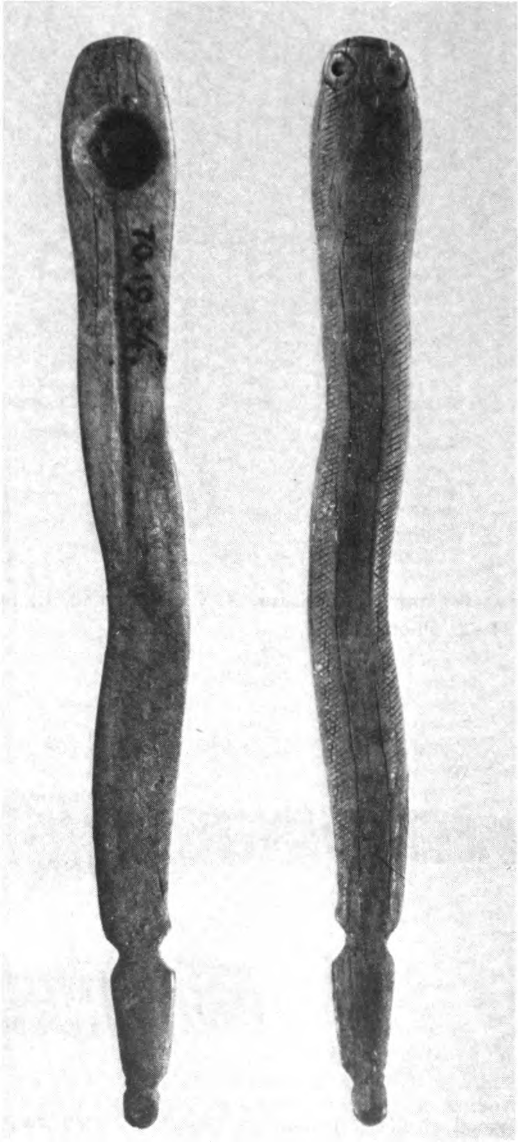
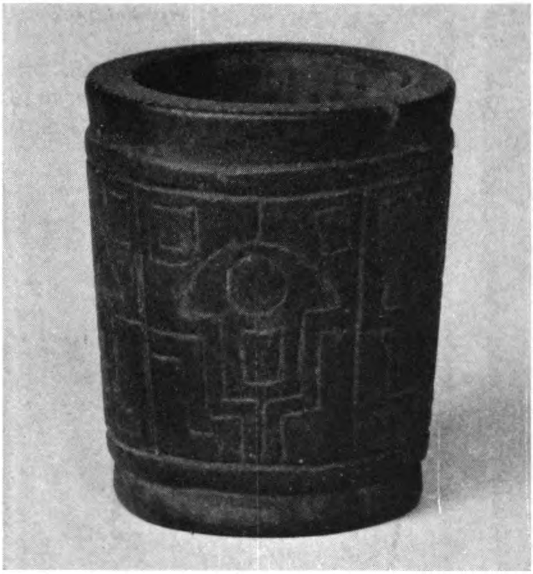


Fig. 28. Spatula of bone in the form of a fish. Niño Korin.
Coll. 70.19.34. L. 14 cm. Photo B.T.



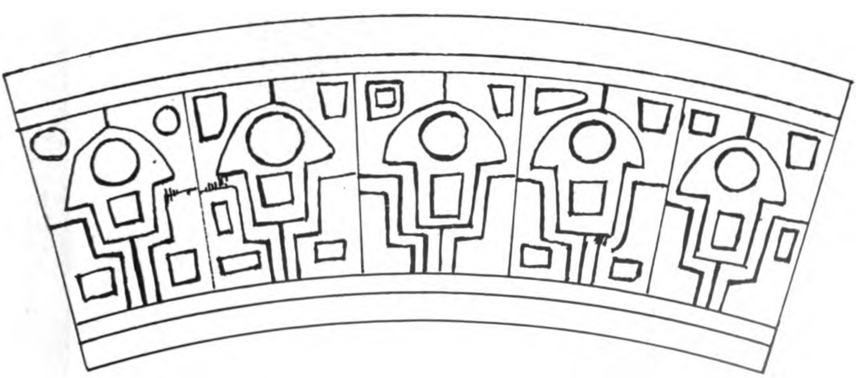


Fig. 29. Wooden mortar and its motif. Niño Korin. Coll. 70.19.30. H. 5.5 cm. Photo Sörvik. Drawing G.H.

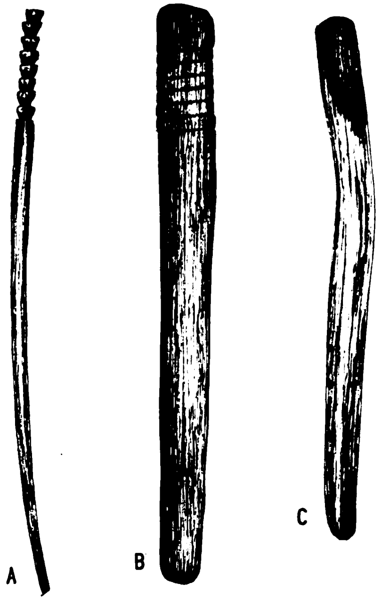


Fig. 30. *A*, Wooden probe (?). Coll. 70.19.28. L. 15.5 cm.
B, Pestle of wood. Coll. 70.19.38. L. 15.5 cm.
C, Pestle of bone. Coll. 70.19.35. L. 13.8 cm.
All specimens Niño Korin. Drawing G.H.

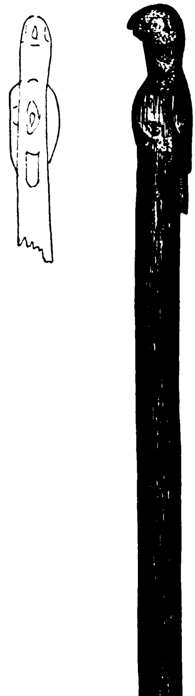


Fig. 31. Parrot stick of wood. Pestle or ceremonial stick? Niño Korin. Coll. 70.19.37. L. 21.5 cm. Drawing G.H.

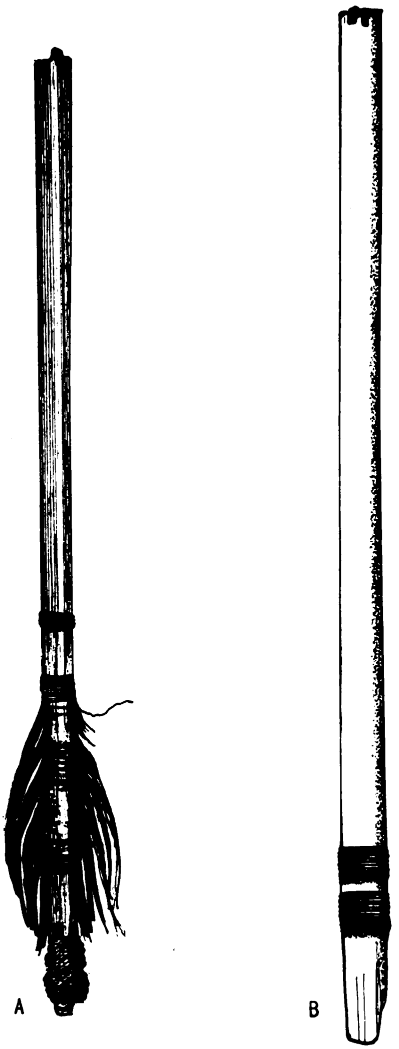


Fig. 32. Broken arrow shafts. Niño Korin. *A*, Coll. 70.19.5. L. 25.5 cm. *B*, Coll. 70.19.4. L.27 cm. Cf. fig. 33. Drawing G.H. See fig. 33.

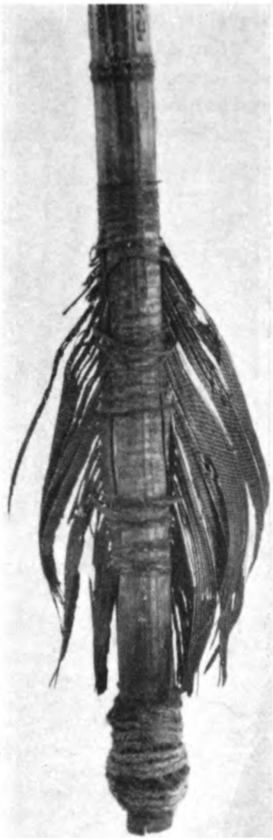


Fig. 33. The feathering of arrow 70.19.5. Photo B.T.

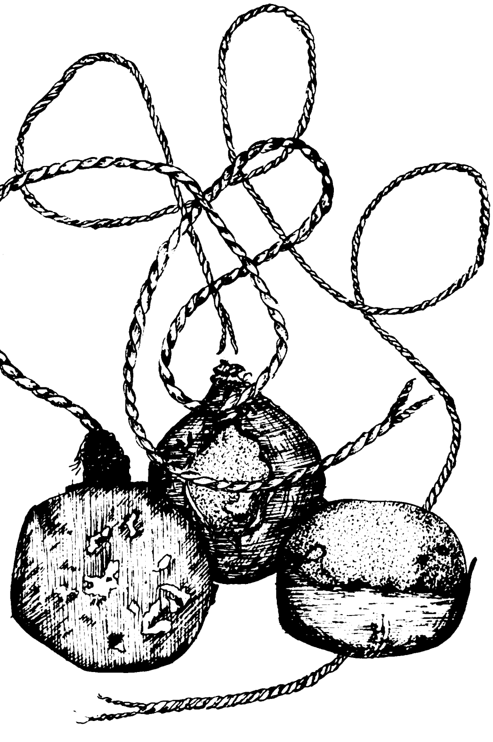


Fig. 34. Three-stone bola. Niño Korin. Coll. 70.19.17 a–d. Drawing G.H.

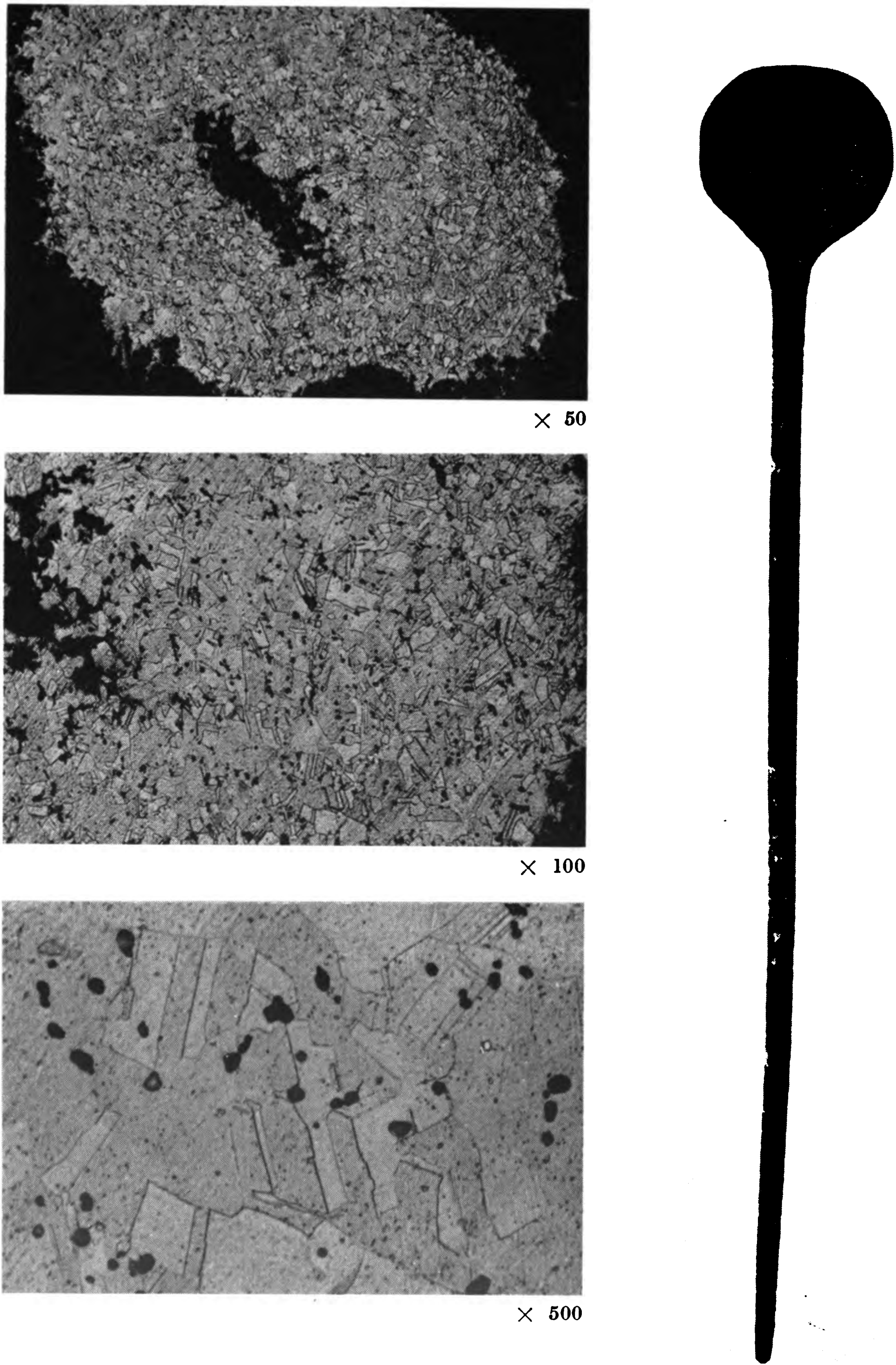


Fig. 35. Metal shawl-pin, *tupu*. Niño Korin. Coll. 70.19.18. L. 21 cm. Photo SKF Stål, Hellefors Jernverk.

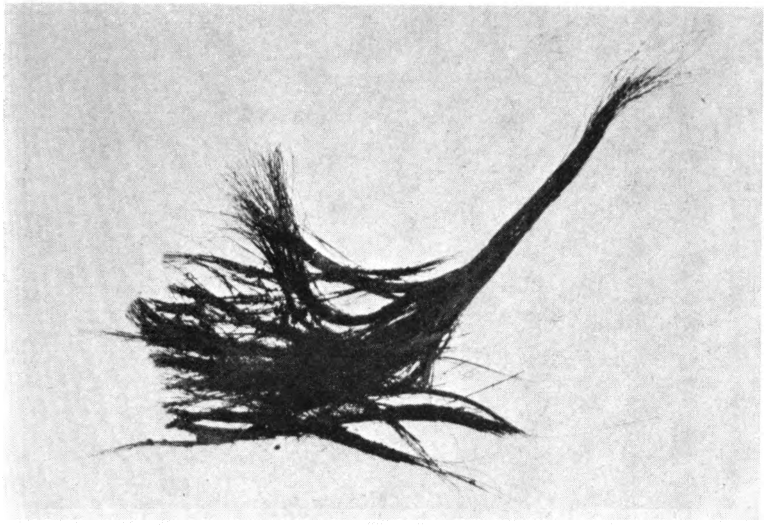
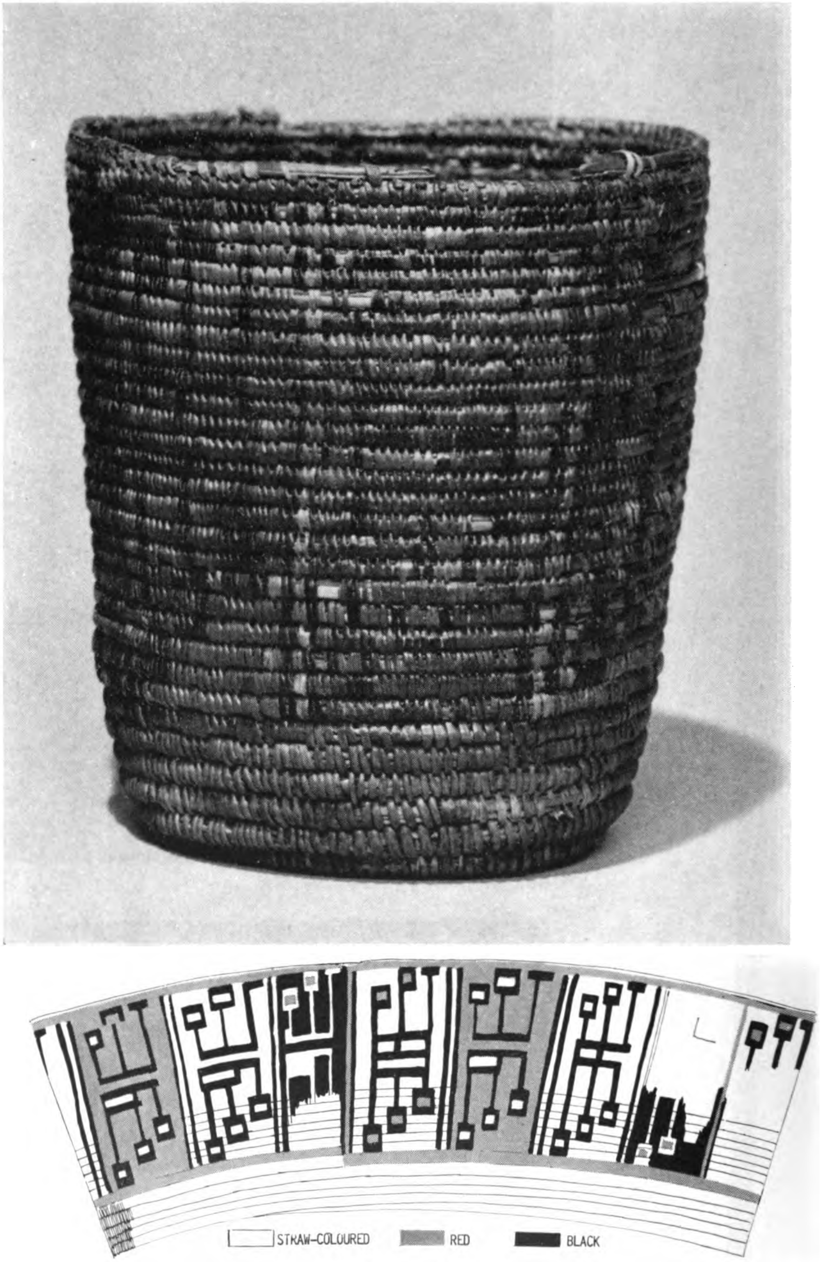
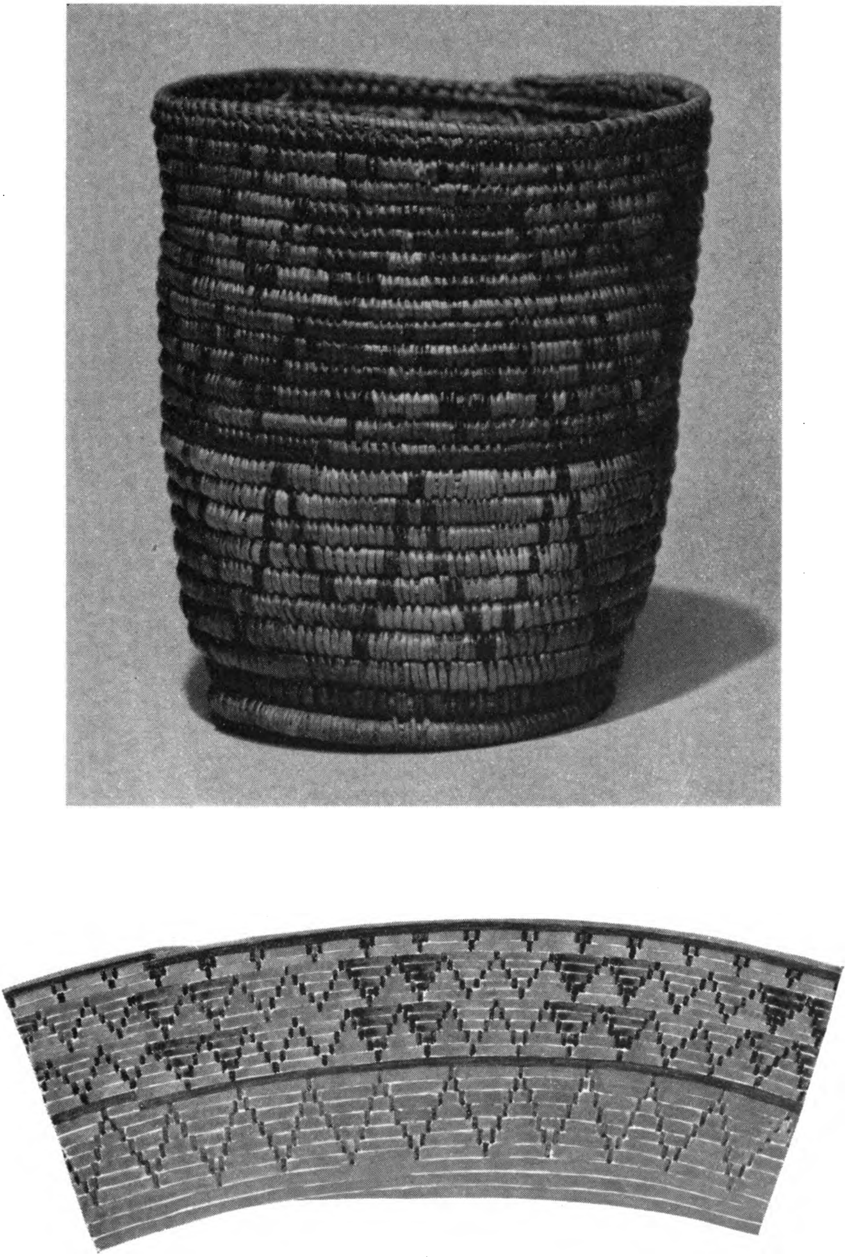


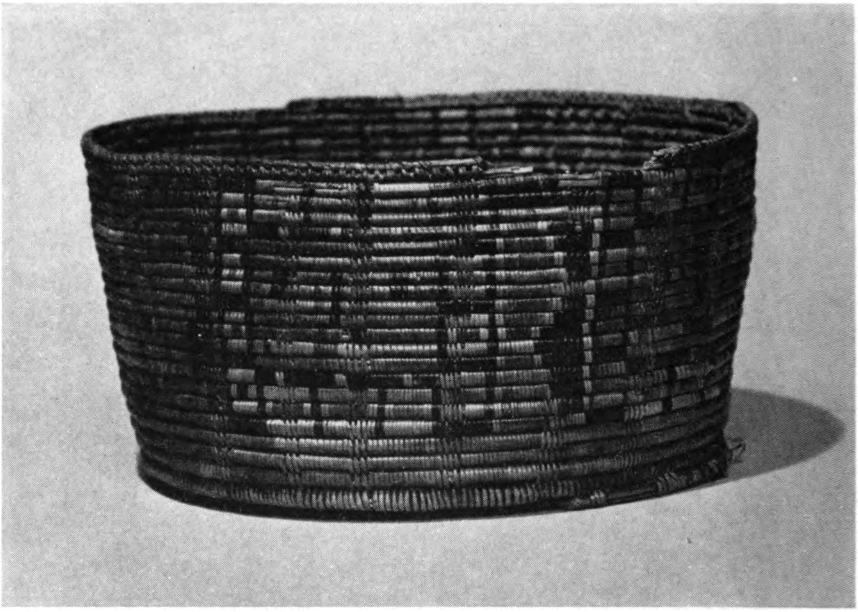
Fig. 36. Tuft of human hair. Niño Korin. Coll. 70.19.56a. Photo B.T.

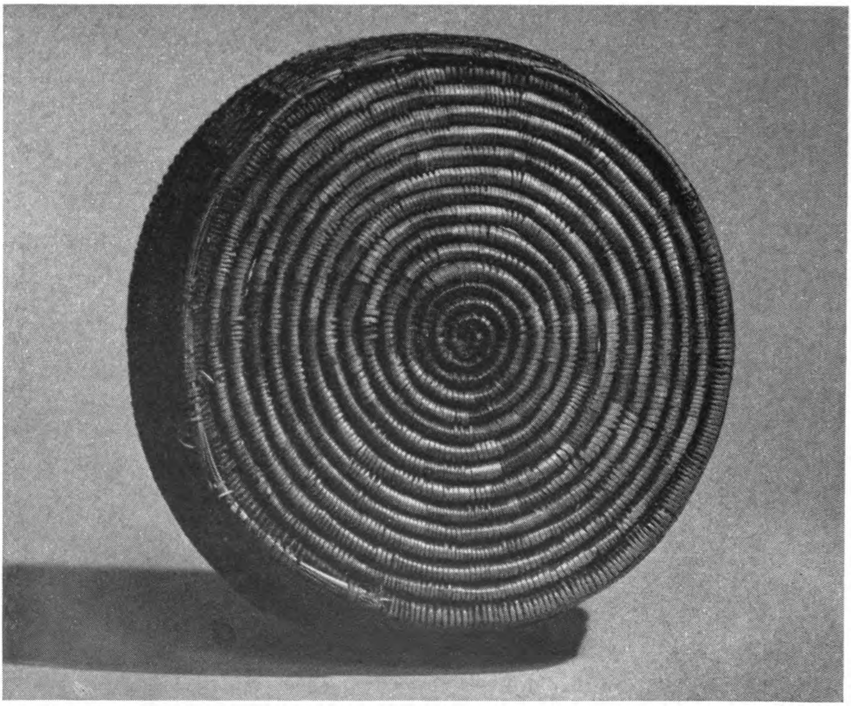


Figs. 37–38. Beaker-shaped basket and its outrolled motif. Niño Korin. Coll. 70.19.39. H. 10.2 cm. Photo Sörvik. Drawing M.A.



Figs. 39–40. Coiled basket and its outrolled motif. Niño Korin. Coll. 70.19.49. H. 9 cm. Photo Sörvik. Drawing M.A.





Figs. 41–42. Spittoon-shaped, coiled basket, side-view and base. Niño Korin. Coll. 70.19.50. H. 8 cm., diam. of base 13.5 cm. For the outrolled motif see Pl. I. Photo Sörvik.

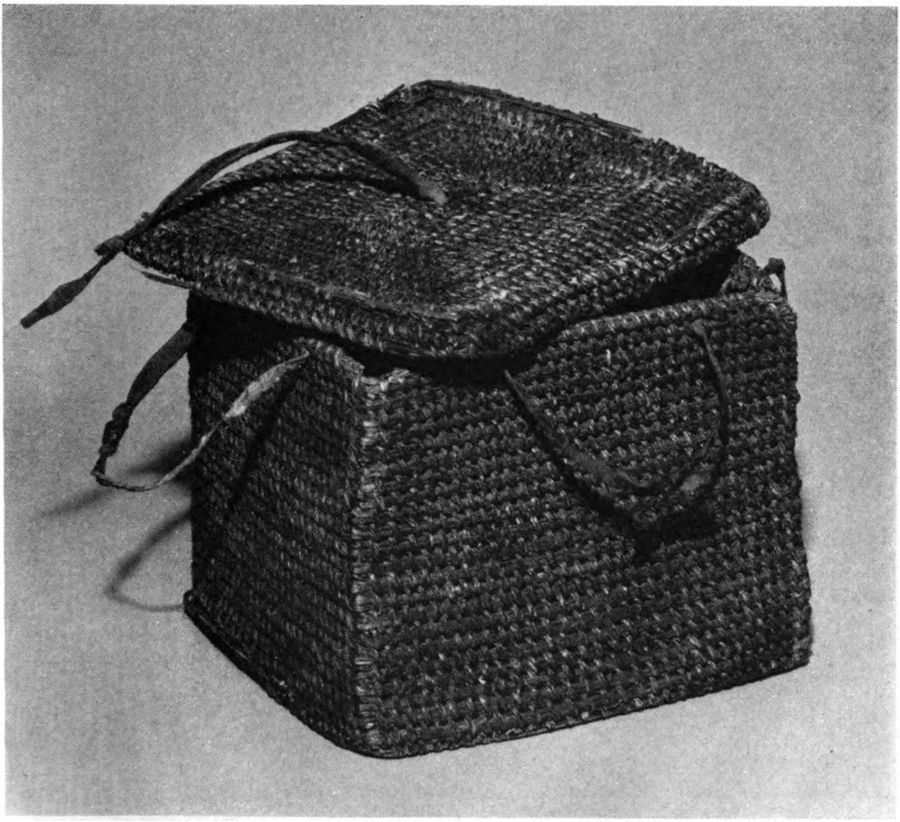


Fig. 43. Square, coiled basket with lid. Niño Korin. Coll. 70.19.51 a–b. H. basket and lid. 15 cm. Photo Sörvik.

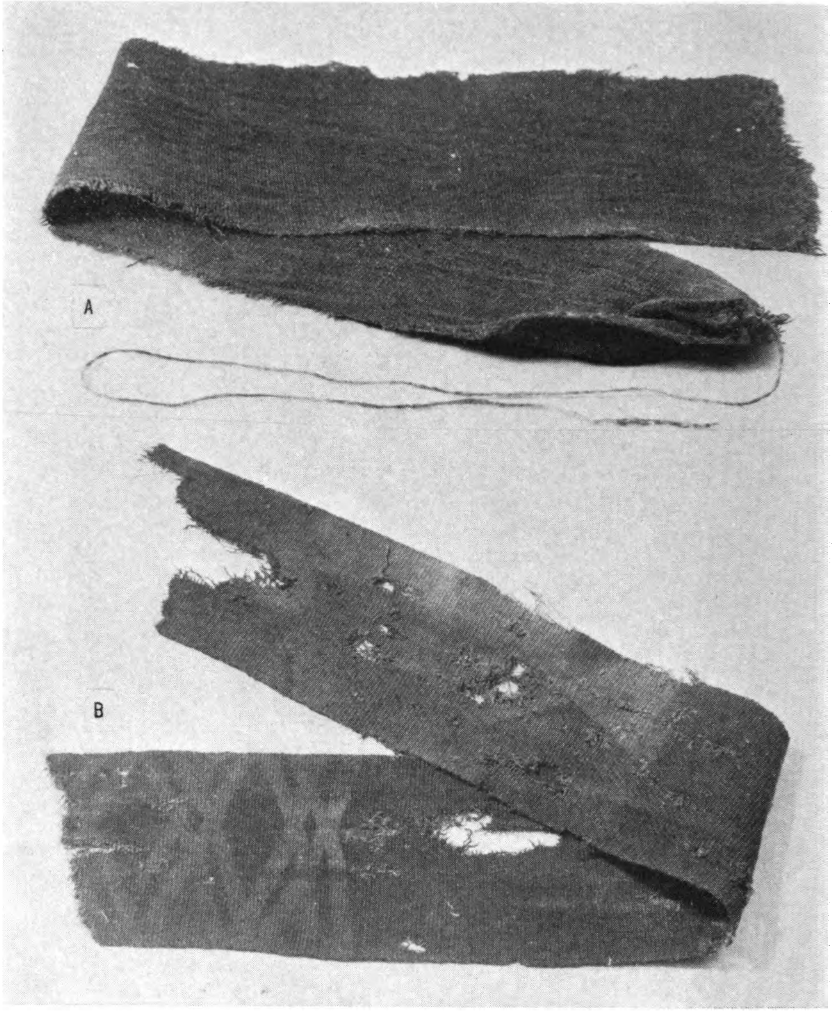


Fig. 44. Woven ribbons from Niño Korin. *A*, Blue, L. 50.7 cm. Coll. 70.19.10. *B*, Dark-yellow, painted in red, L. 50.8 cm. Coll. 70.19.11. Photo T.I.

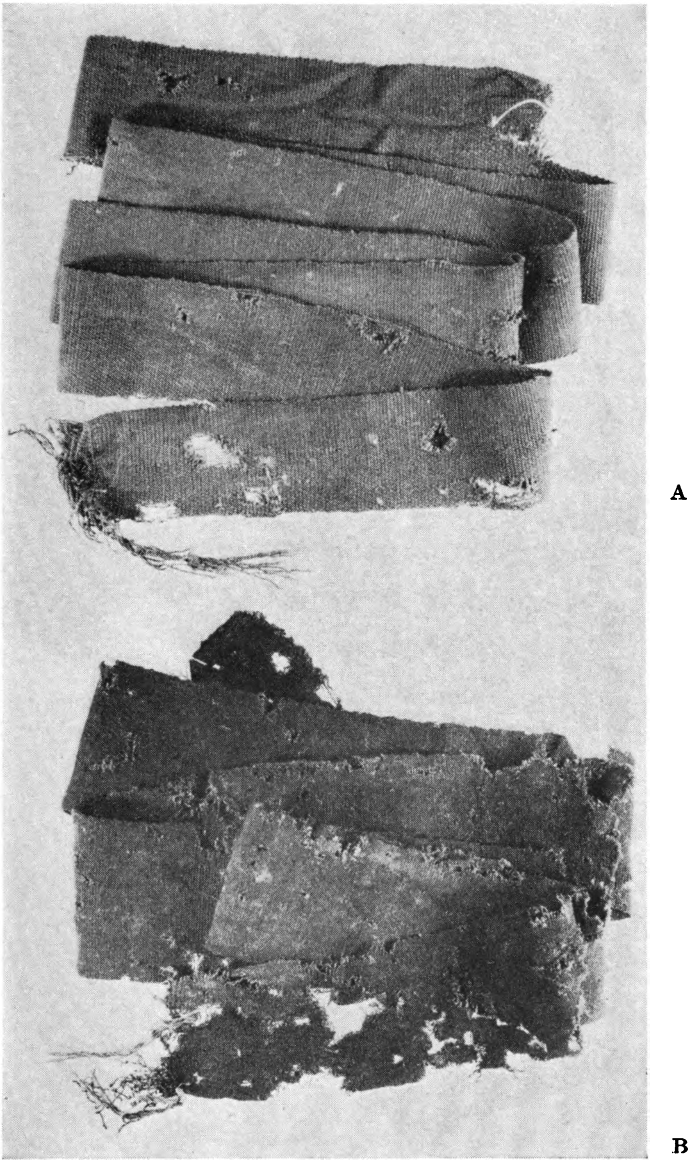


Fig. 45. Ribbons, Niño Korin. *A*, Red, L. 200 cm. Coll. 70.19.55. *B*, Blue, L. 230 cm. Coll. 70.19.56. Photo B.T.

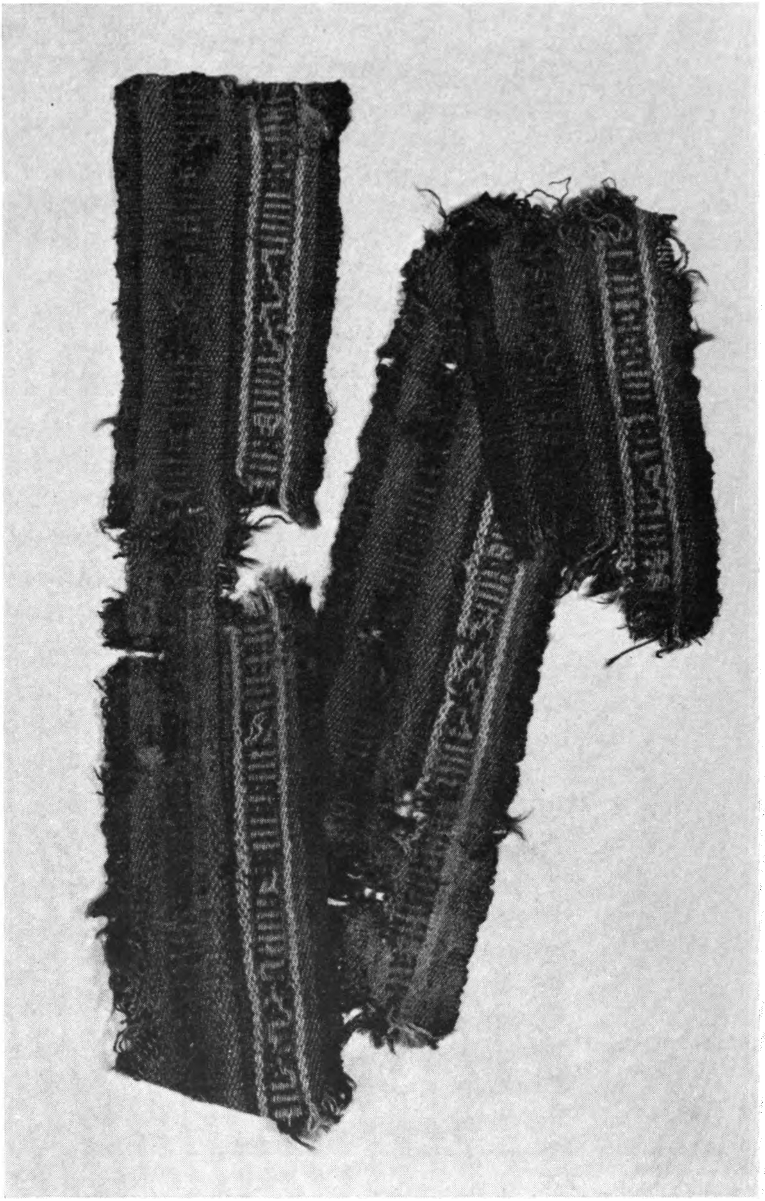


Fig. 46. Ribbon from Niño Korin. Coll. 70.19.60. L. 64 cm. Photo Sörvik.

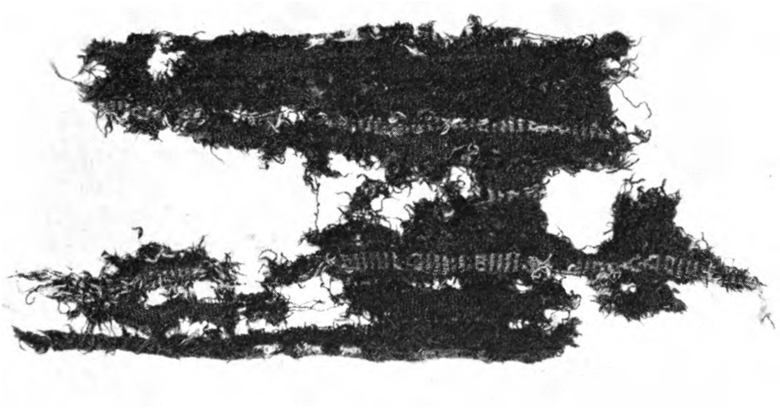


Fig. 47. Textile fragment, Niño Korin. L. about 52 cm. Coll. 70.19.59. Photo Sörvik.

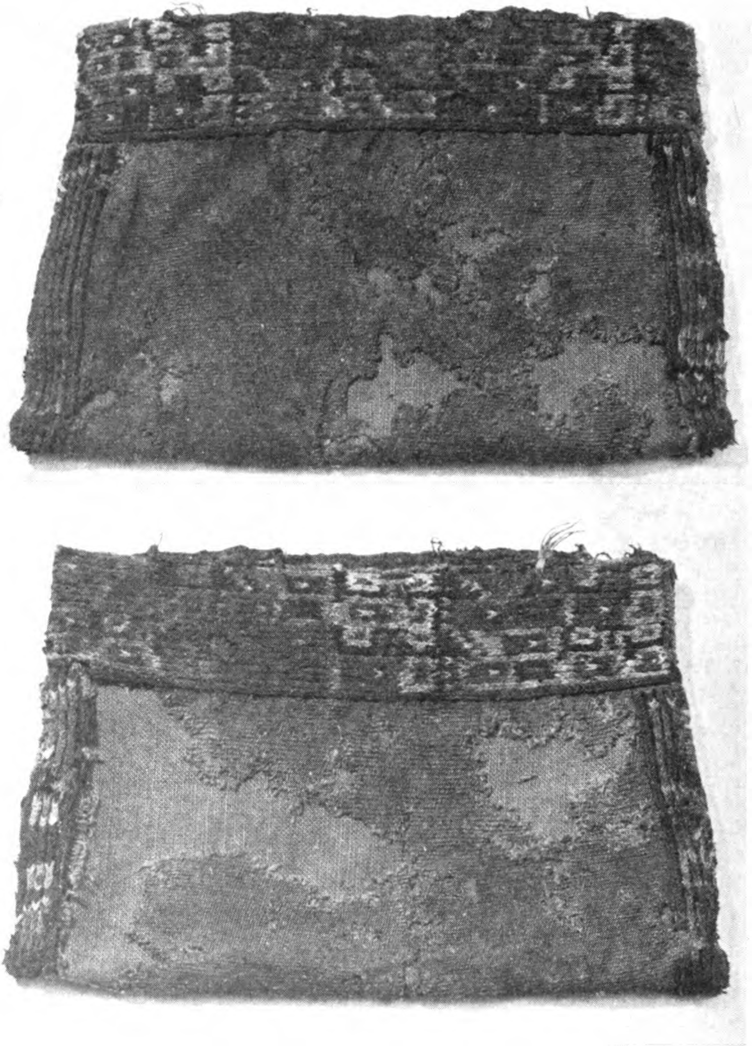


Fig. 48. Woven bag with embroideries, after mending. Size 13.5 × 18–20 cm. Niño Korin. Coll. 70.19.20a. Contained leaves of *Ilex Guayusa*. See Pl. II, A. Photo T.I.

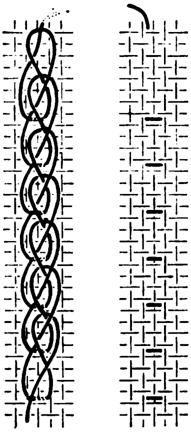


Fig. 49. Embroidery technique in the bag 70.19.20a. After d'Harcourt.

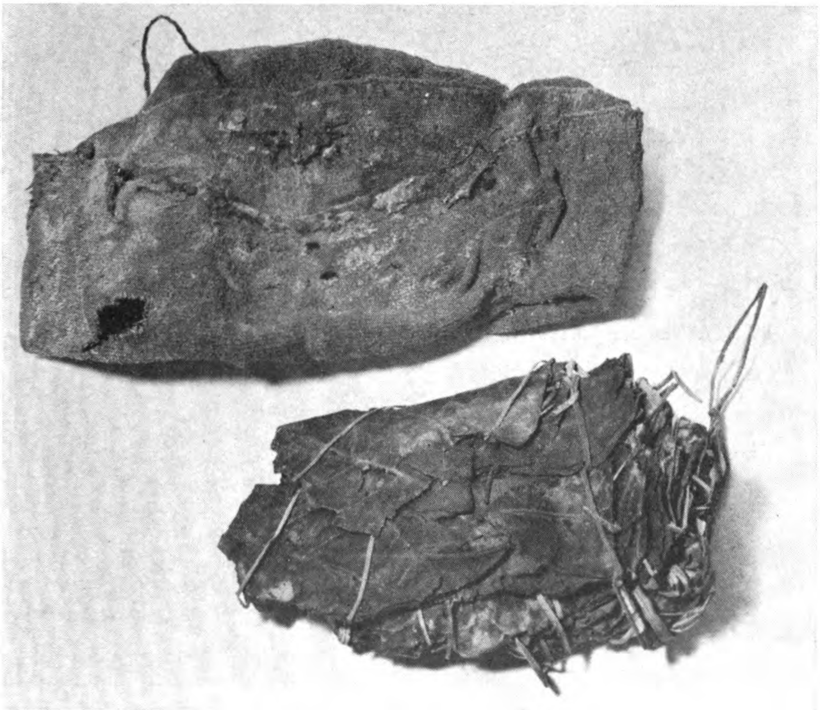


Fig. 50. Light-brown woven bag from Niño Korin with leaves of *Ilex Guayusa* found in this bag. Coll. 70.19.52a, before cleaning. Photo B.T. See fig. 51.

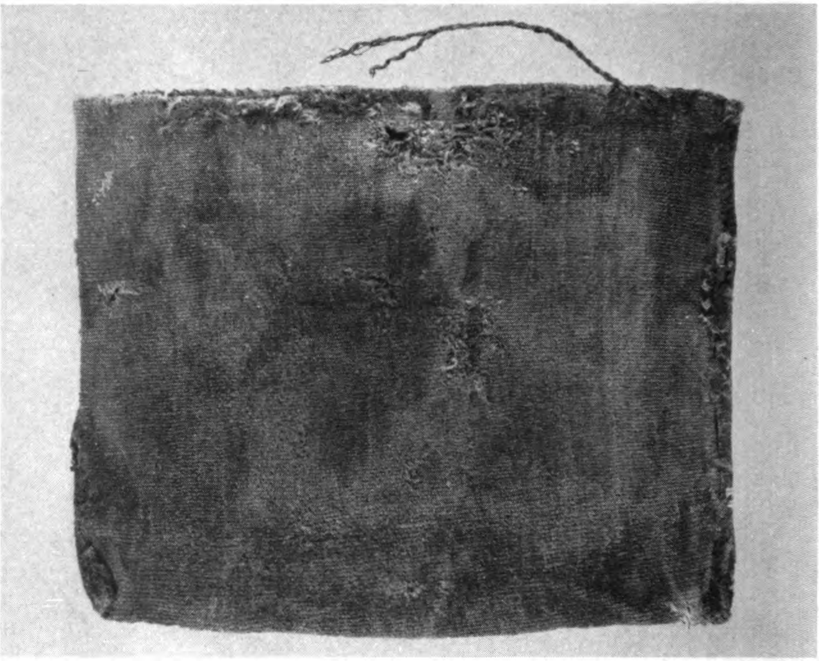


Fig. 51. The bag 70.19.52a, having been cleaned. Size 17 × 21 cm. Photo B.T.

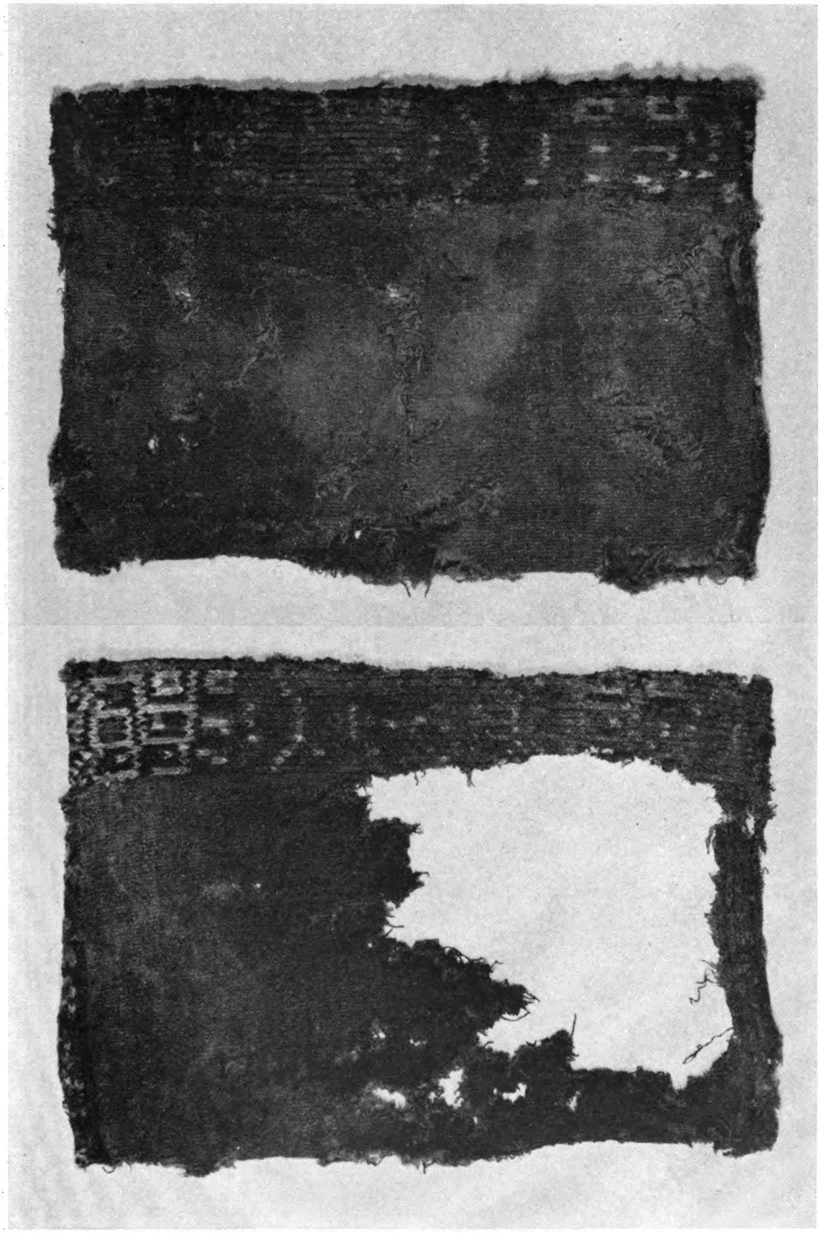


Fig. 52. Bag with embroideries from Niño Korin. Size 14.5×21 cm. Coll. 70.19.53. See Pl. II, B, for the motif. Photo Sörvik.

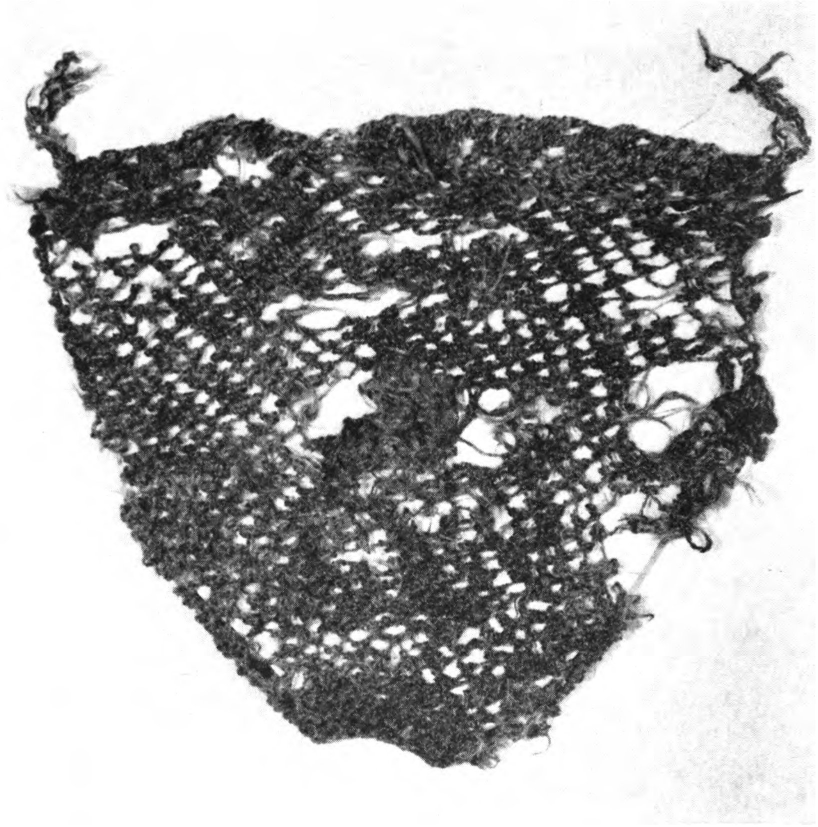


Fig. 53. Network bag from Niño Korin. H. about 16.5 cm. Coll. 70.19.54. Photo Sörvik. See fig. 54.

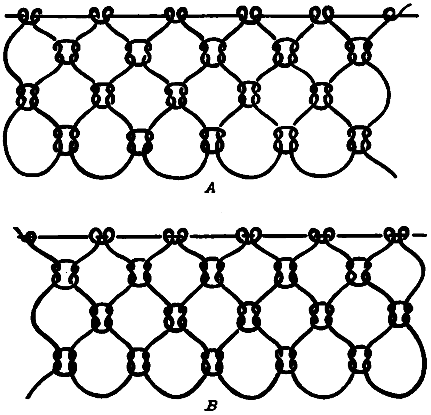


Fig. 54. Technique in the bag 70.19.54. After d'Harcourt.

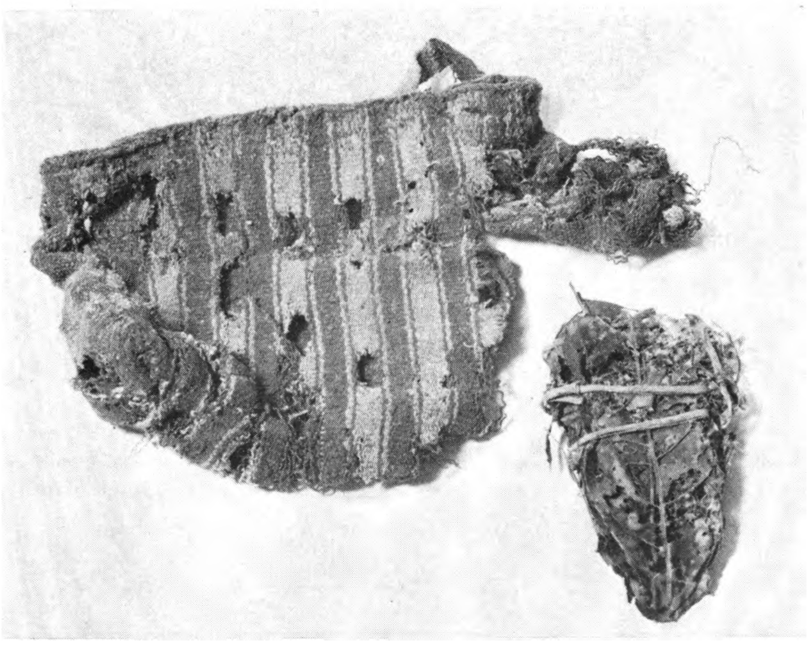


Fig. 55. Striped bag as found turned inside out. Niño Korin. Coll. 70.19.58a. Bundle of *Ilex Guayusa* leaves as found in this bag. For a colour photo see Pl. III A. Photo T.I.

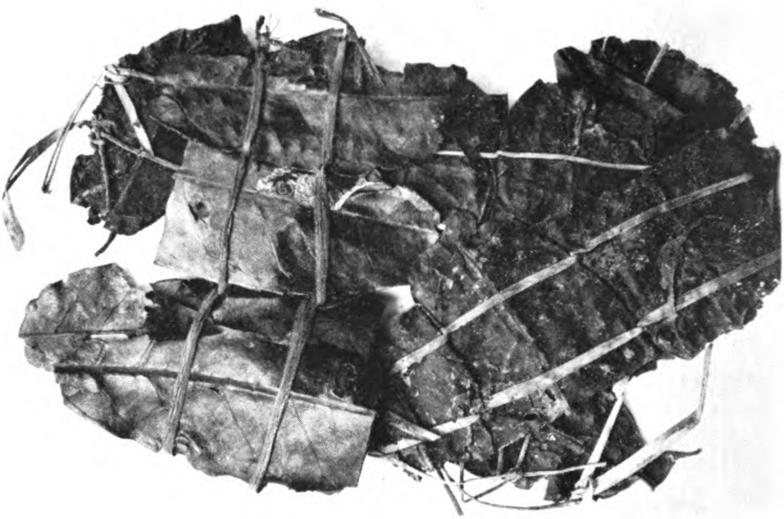


Fig. 56. Leaves of *Ilex Guayusa* found in the bag 70.19.20a. Photo B.T.

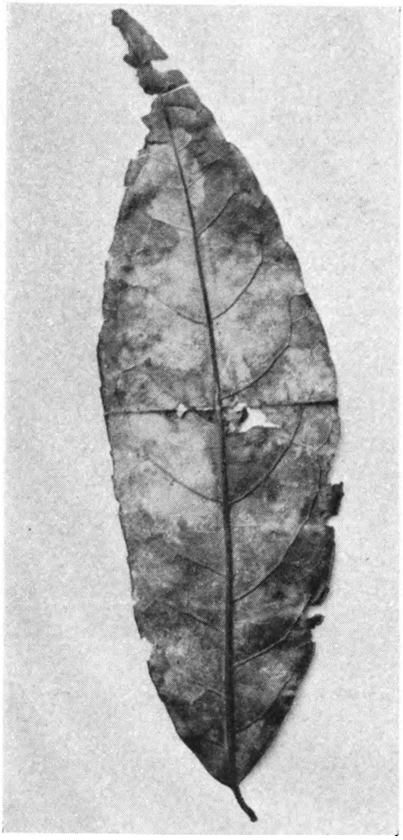
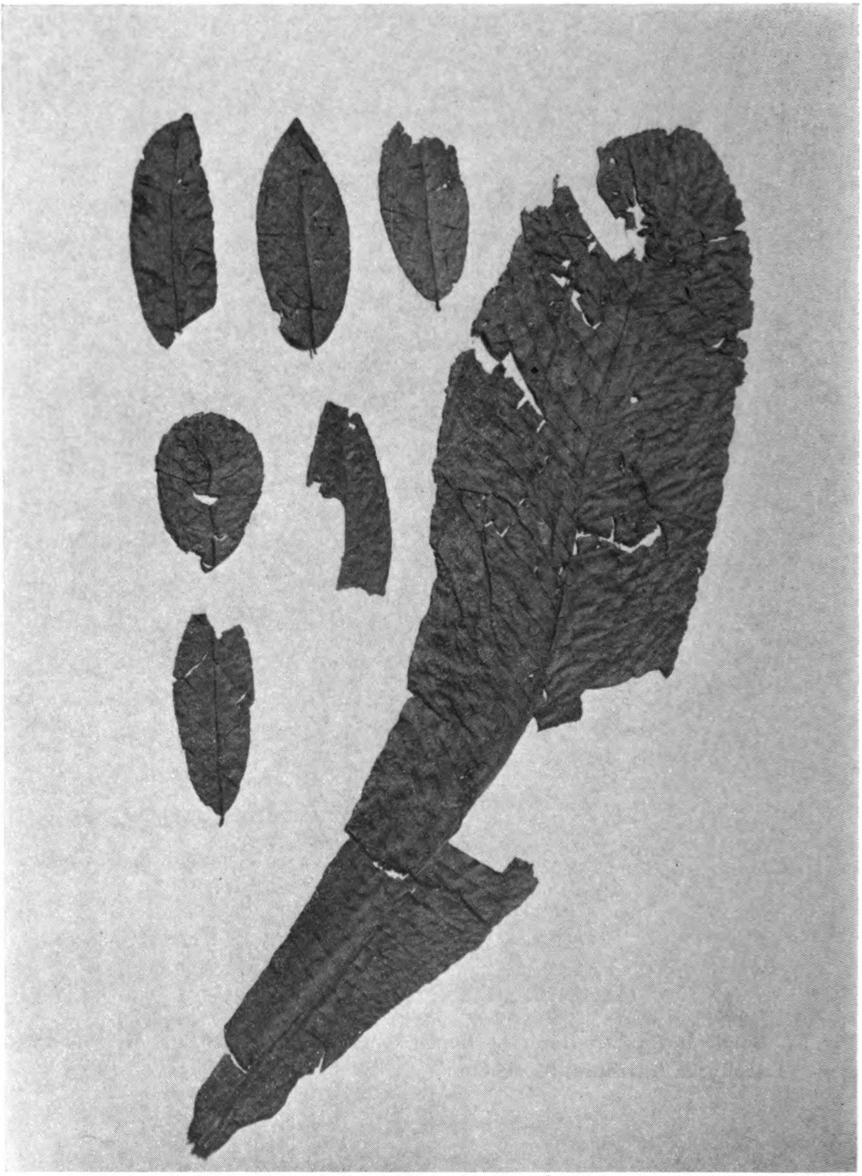


Fig. 57. Single leaf taken from the bunch found in bag 70.19.20a, fig. 56. Photo Karolinska Institutet, Stockholm.



Figs. 58–59. Big leaf of *Duroia* aff. *saccifera* and several leaves of *Ilex Guayusa* which were found wrapped in the *Duroia* leaf. Niño Korin. Coll. 70.19.41 and 42–47. The Duroia leaf (41) measures 17 × 52 cm. Photo T.I.

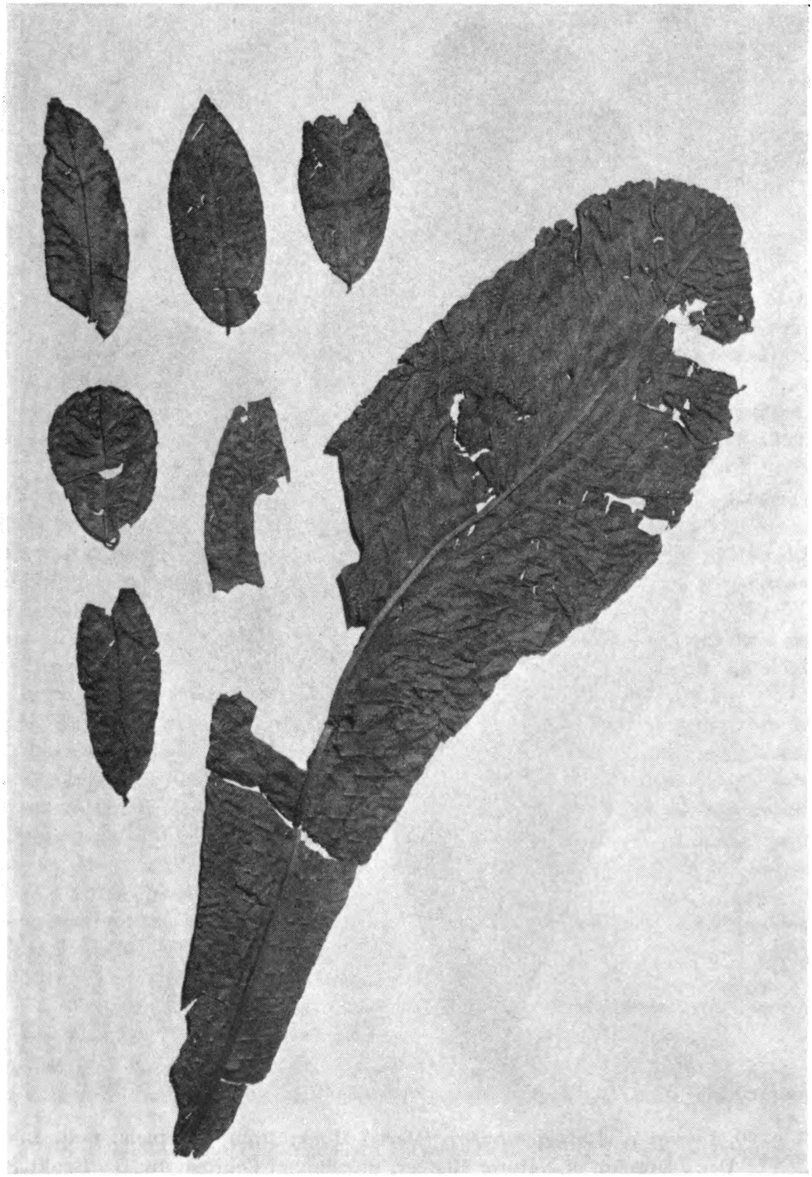


Fig 59.

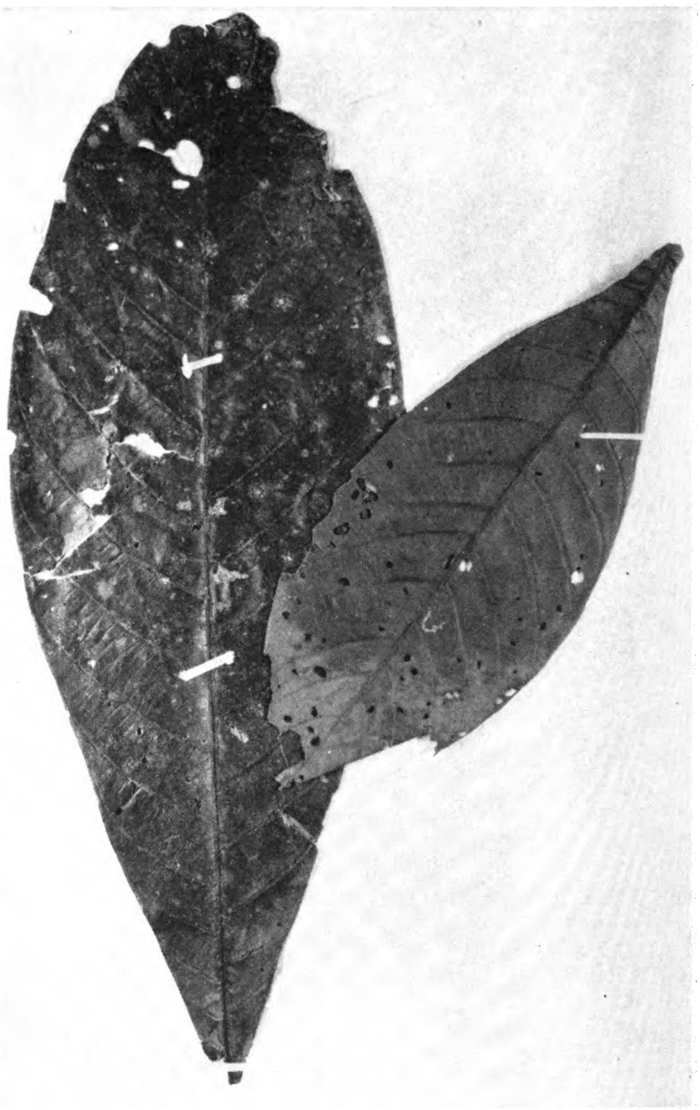


Fig. 60. Leaves of *Duroia saccifera* (Mart.) Hook, from Venezuela. Coll. Botanical Dep., Museum of Natural History, Stockholm. Courtesy by Dr. Benkt Sparre.

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Abbreviations:

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ILEX GUAYUSA FROM 500 A.D. TO THE PRESENT

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I.

The recent find in the tomb of a medicine man from a Tiahuanacoid Culture in highland Bolivia of leaves of a holly represents ethnobotanically one of the most interesting and possibly most significant discoveries of the last several decades. The material is dated by radiocarbon measurements at about the fifth century.

Amongst the several artifacts in this find—a snuffing tube, other tubes that have been interpreted as clysters, bamboo storage tubes for powder, spatulas, snuff trays, a mortar and pestle and a hollow fruit-capsule container—were several bundles of flattened leaves neatly tied with fibrous material and so perfectly pressed that one might logically compare them with recently prepared dried herbarium specimens. One of these bundles was wrapped in a large leaf; three had been packed in bags or pouches.

The several kinds of tubes appear to be referable to *Arthrostylidium*. The snuff trays are made from a soft, light wood which has not yet been identified. The bundles of flattened leaves represent *Ilex Guayusa* Loes. The fibrous material tying these bundles is probably monocotyledonary. The large leaf used as a wrapper had been determined by Harling and Sparre as a species of *Duroia*, possibly *D. saccifera* Benth. et Hook. The capsule container is the lecythidaceous *Cariania decandra* Ducke. The leaf fragments have yet definitively to be pharmacognostically identified.

Several factors concerning the leaves of *Ilex Guayusa* are especially noteworthy. The leaves were prepared for the grave with great care, indicating that they had been included in the burial for a specific purpose. This purpose may now only be guessed at: was it for medicine, stimulant, food, hallucinogen or for some merely symbolic significance?

The leaves gave positive tests for caffeine. No other alkaloids nor biodynamically active principles were found in them.

This discovery of caffeine was not unexpected, inasmuch as over a century ago Jameson (12) reported that guayusa "a species of *Ilex* . . . which abounds in the Provinces of Quijos and Canelos" contained caffeine.

Other hollies are known to contain caffeine or from their use as stimulants are suspected to contain this compound. *Ilex paraguariensis* St. Hil. or "yerba maté" of southern South America and *I. vomitoria* Ait. or "yaupon", source of the "black drink" of the Indians of southeastern North America, are employed as economic plants for their relatively high content of caffeine. In addition to these major and well known caffeine-containing hollies, a number of other species are locally employed to prepare stimulating beverages or as additives to some of the major species which are the source of such drinks. The leaves of *Ilex yunnanensis* Franch. var. *eciliata* Hu or "shui-cha-tze" (meaning "water tea" or "tea growing by the water") are employed as a substitute for real tea (*Camellia sinensis* (L.) O. Ktze.) in the border region between Tibet and China (10, 11). Four North American species are utilized in the same way as is *Ilex vomitoria* (9): *I. Cassine* Walt. (9), *I. glabra* A. Gray (23), *I. Perado* Ait. (=*I. quercifolia* Meerb.) (23) and *I. verticillata* A. Gray (23). In southern South America, the leaves of *Ilex amara* Loes., *I. conocarpa* Reiss ex Mart., *I. fertilis* Reiss ex Mart., *I. pseudobuxas* Reiss ex Mart. and *I. theezans* Mart. are the source of stimulating beverages of lesser importance (28). Still other species of Ilex have been indicated as sources of stimulant drinks in South America. Hartwich (8) enumerates *I. affinis* Gardn., *I. chamaedryfolia* Reiss. ex Mart., *I. cognata* Reiss. ex Mart., *I. Congonhina* Loes., *I. cuiabensis* Reiss. ex Mart., *I. diuretica* Mart. in Reiss. ex Mart., *I. dumosa* Reiss. ex Mart., *I. Glaziouviana* Loes., *I. paltorioides* Reiss. ex Mart., *I. pseudothea* Reiss. ex Mart., *I. symplociformis* Reiss. ex Mart., and *I. vitis-idaea* Loes. *I. tarapotina* Loes. has likewise been suggested (18) as the source of a tea in eastern Peru.

No caffeine containing plant has ever been known to be used anywhere except in the form of a beverage. Consequently, an obvious assumption would be that these archaeological leaves of *Ilex Guayusa* were placed in the burial for use by the deceased as a beverage. The presence in the burial, however, of a mortar and pestle, snuff trays and tubes of a kind suggestive of use in snuffing offers us an unconfirmable suspicion that these leaves might have been placed in the grave for the preparation and use by the deceased of a snuff. Although we lack direct evidence that the leaves were destined to this purpose, there is no reason to believe that caffeine administered in this way would not be absorbed into the general circulation through the nasal mucosa. The administrating by snuffing of intoxicating preparations of tobacco and of the hallucinogenic *Anadenanthera* (*Piptadenia*) is known to have been practiced in this general area of South America.

If this suspicion that *Ilex Guayusa* were the source of a snuff proved to be true, then it would represent the first time that any caffeine-rich plant in either the Old World or New is known to have been employed in this way.

The presence in the burial of tubes of a type known to have been utilized as clysters hints—even if remotely and tangentially—even more strikingly at the possibility of the use of *Ilex Guayusa* as an enema. While no caffeine plant has ever been known to be employed in this manner, the fact that rectal administration of tobacco and *Anadenanthera* is widespread in South America should here be remembered.

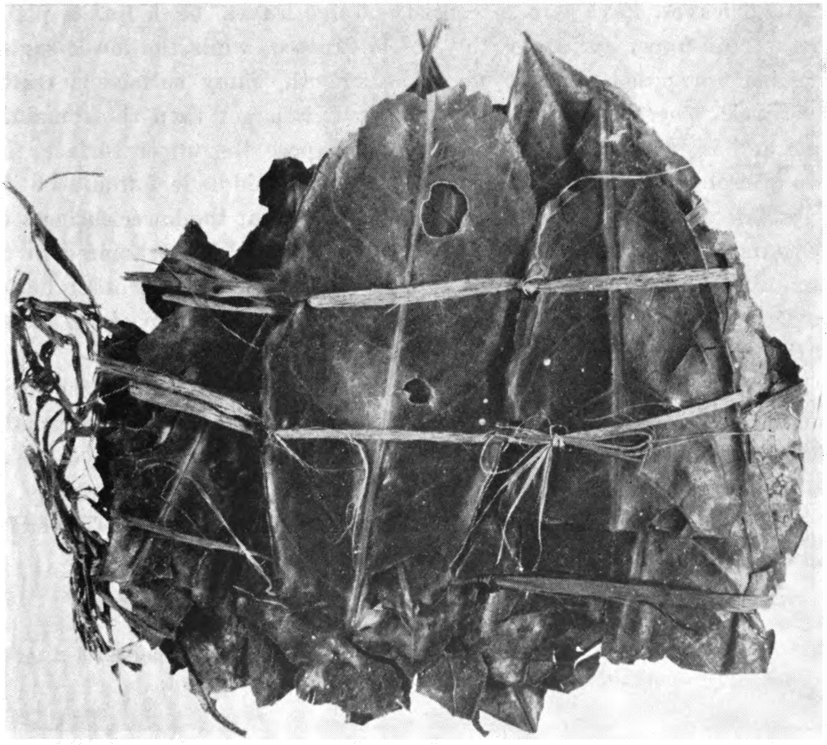


Fig. 1. Photograph of archaeological leaves of *Ilex Guayusa* from Bolivia. Gothenburg Ethnographic Museum, Coll. 70.19.20*b*. Photograph by B. Thörnborg.

II.

Description of the leaves of Ilex Guayusa found in the archaeological site:

Folia firme chartacea vel subcoriacea, elliptica vel elongato-elliptica, usque ad 16 cm. longa et 5 cm. lata (siccitate), acuta, basi late cuneata, in petiolo apparenter crasso, canaliculato, usque ad 7–10 mm. longo, usualiter 1.5 mm. in diametro producta, margine leviter incurvata, distante crenato-serrata, dentibus (6–) 10 mm. distantibus, glabra, apparenter vivo supra nitida atque subtus pallidiora, nervo centrale supra valde impresso, subtus conspicue elevato, nervis secundariis vel lateralibus utrinque 7–10, sub angulo plus minusve 45–60° patentibus, juxta basin sibi plus minusve approximatis et sub angulo angustiore obviis, omnibus ad apicem versus arcuatis, minoribus inconspicuis, subreticulatis.

A peculiarity in the packing of these dried leaves which may have magical significance has been brought to my attention by my graduate student, Mr. Robert Bye: "While studying the two leaf bundles of *Ilex Guayusa*, I have noticed a possible specific construction of the bundles of dried leaves. Each bundle consists of five leaves. Each leaf is placed so that the upper surface of the leaf is exposed, while the lower surface remains unexposed. In this way, the smooth, shiny surface is readily noticeable. The middle leaf of each bundle is larger than the remaining four and is transversely folded so as to expose the upper surface. The two lateral pairs of leaves are shorter than the middle leaf would be if it were unfolded. Each pair of leaves is turned so that the lower surfaces are in contact, exposing the upper surfaces. The petioles are pointed in the same direction in one bundle, although the petioles in the other bundle point in either direction. Is it possible that the construction of the bundle of five *Ilex Guayusa* leaves has any magical significance?"

The dried leaves are a rich chocolate brown, still glossy on the upper surface, duller and paler on the nether surface. They are, in general, smaller than those found on the few modern herbarium collections of *Ilex Guayusa*; but, in other aspects, they match the leaves of this species perfectly.

Ethnobotanical Collection, Botanical Museum, Harvard University. Accession No. 36/1.

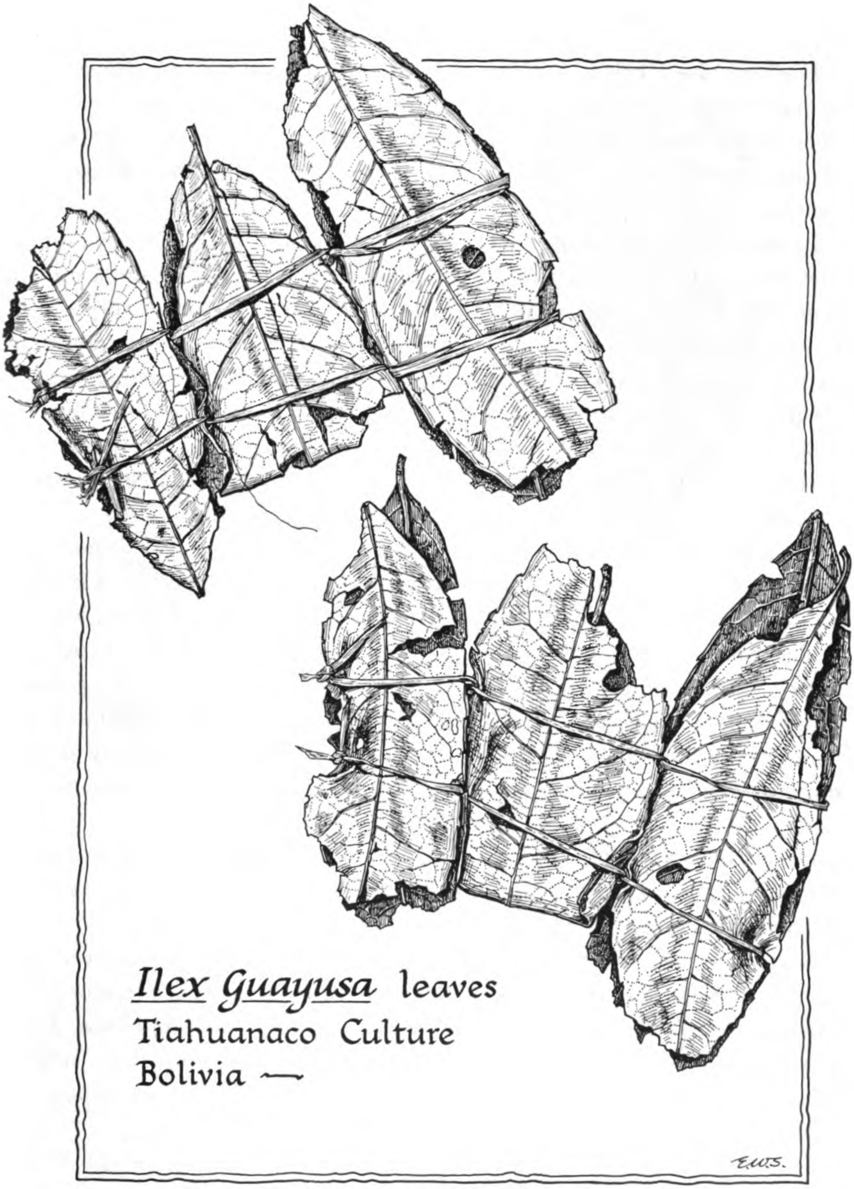

Ilex Guayusa leaves
Tiahuanaco Culture
Bolivia —
E.W.S.

Fig. 2. Drawing of archaeological leaves of *Ilex Guayusa* from Bolivia. Coll. Gothenburg Ethnographic Museum. Drawn by E. W. Smith.

III.

Loesener described *Ilex Guayusa* as a "species nova atque dubia", since he had available no flowering or fruiting specimens. Stating that it was without any doubt allied to *Ilex paraguariensis* and *I. nitida* (Vahl) Maxim., he distinguished it by its larger leaves, the tips of which are acutely acuminate.

In the original description, Loesener outlined its range as Ecuador and northern Peru. He cited two collections: one from Huancabamba and one from Jaen Bracamoros—made by Warszewicz and Lagerheim respectively. Both collectors gave the vernacular name *guayusa*, and both mentioned its use in the preparation of a tea resembling that of *Ilex paraguariensis*.

Curiously enough for a locally very important plant, there have been few collections made of *Ilex Guayusa*—notwithstanding relatively sustained botanical studies along the eastern slopes of the Andes of southern Colombia, Ecuador and northern Peru.

Although Richard Spruce, the English plant-explorer, was thoroughly familiar with guayusa, he apparently did not make a collection of it during his work in Amazonian Peru and Ecuador some 115 years ago (25).

There is in the herbarium at Kew an unidentified collection of *Ilex* made during the last century in Guilaguiza and Zamora, Ecuador (*E. C. Lehmann 5581*). I have examined the specimen, which has a few remnants of dried fruits still adhering to the twigs, and believe that, while it may possibly represent *Ilex Guayusa*, it can be so determined only with strong reservations.

On October 21, 1939, Dr. Erik Asplund of the Riksmuseet in Stockholm made an excellent collection of *Ilex Guayusa* in Tena, Provincia Napo-Pastaza, Ecuador (*E. Asplund 9485*). This collection is sterile.

Several significant collections, all from cultivated sources, were made by my student, Mr. Homer V. Pinkley, in 1966 in eastern Ecuador (*H. V. Pinkley 199*, *454*, *455*, *456*), respectively at Dureno, Río Aguarico; Puerto Napo; between Tena and Archidona; and Archidona, Guayura. Notes on these collections state that the leaves are prepared as a tea drunk as a "health tonic" and, amongst the Jivaro, as an "emetic".

Like the other three collections of undoubted *Ilex Guayusa*, the Pinkley material is all sterile. In a personal communication, Pinkley informs me that local missionaries assert that guayusa does flower, and, in fact, on December 30, 1968, Mr. W. G. Tidmarsh wrote to Pinkley from the field as follows: "Yes, guayusa *does* have a flower. Last time I was down in

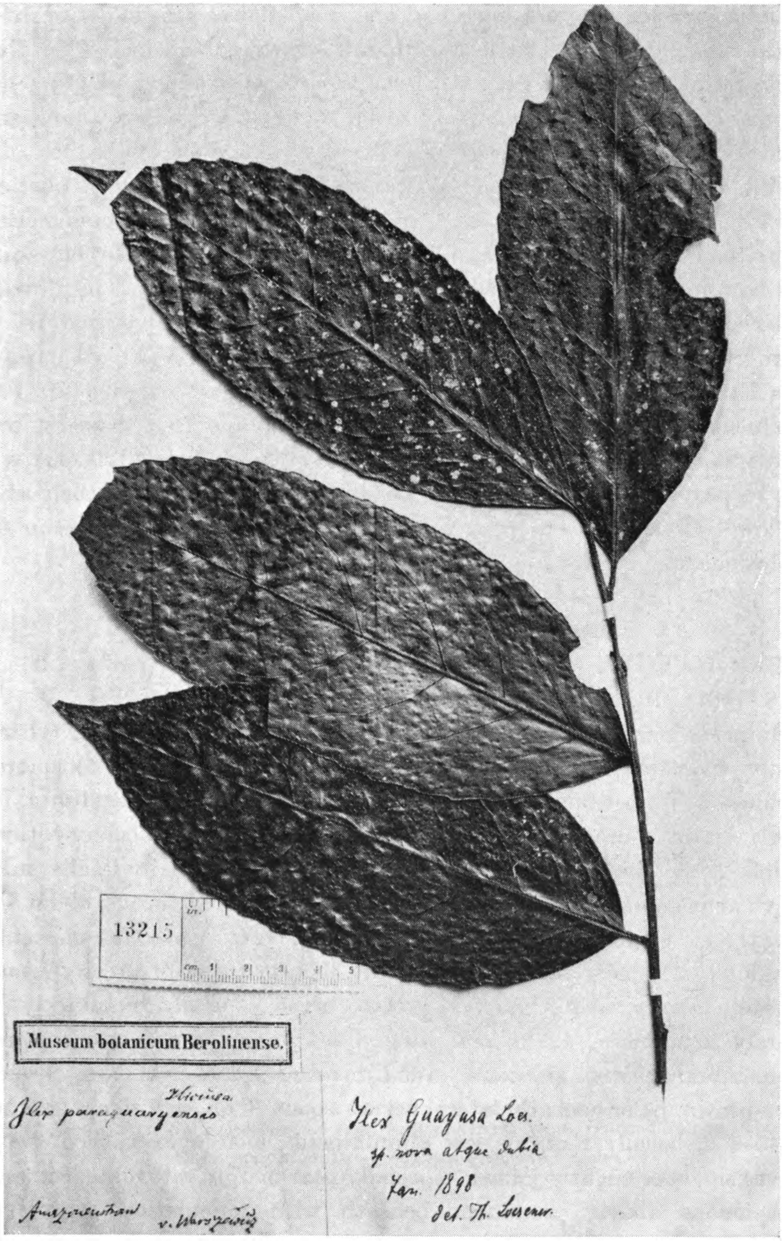


Fig. 3. *Warsczewicz* collection of *Ilex Guayusa* from eastern Peru, cited by Loesener in original description. Photograph courtesy of Field Museum of Natural History, Chicago, Ill.

Shandia, our big guayusa bush had one small flower growing straight out of the stem, its stem a little less than a quarter of an inch. The flower made up of petals making a bowl shape, and a very pale yellowy green colour. The flower was out of my reach, so I cannot tell you how many petals or give you more exact details."

Pinkley (pers. comm.) believes that the lack of flowering of bushes of *Ilex Guayusa* may be due to the custom of very heavy pruning carried on by the natives and that, if and when wild bushes are located, blossoming will be found to occur normally. The truth is, however, that no flowering material has ever been made available to scientific investigators, and there can be no doubt that the several outstanding botanical explorers who have collected the species must assuredly have searched for fertile specimens. Consequently, the suspicion exists that *Ilex Guayusa* might represent one of those cultigens which, like others—especially those which can be propagated vegetatively in the wet tropics—have lost their ability to flower or which flower so irregularly and so seldom that they seem to be evolutionarily on the way towards losing the flowering habit.

ILEX GUAYUSA *Loesener* in Nova Acta Acad. C.L.C.G. Nat. Cur. 78 (1901) 310.

Branches glabrous or subglabrous, sometimes minutely and longitudinally thinly striolate. Leaves large, 2.5–4.5 cm. long; stipules conspicuous, subulate-deltoid, sometimes becoming ashy, acute, up to hardly 1 mm. long, short- or, in comparison with length of the blade, very short-petiolate; petiole 22–26 times shorter than leaf blade, usually longitudinally sulcate above about half its length and more or less rugulose, glabrous, about 1.6–2 cm. thick; blade oblong or oblong-elliptic, rarely subovate-lanceolate, marginally for most part very narrowly recurved, rather grossly crenate-serrate, basally acute or subcuneate-obtuse, apically manifestly and acutely acuminate, 18–21 cm. long, 6.5–7.5 cm. wide, chartaceous or submembranaceous, glabrous, usually rather glossy above, obscurely olive-brown, paler beneath, lateral nerves about 10 on each side, at an angle of 45–60°, basally more or less approximate, near apex curved, smaller nerves single or slightly joined, especially near margin reticulate, somewhat conspicuous above, prominent beneath with reticulation conspicuous, especially beneath.

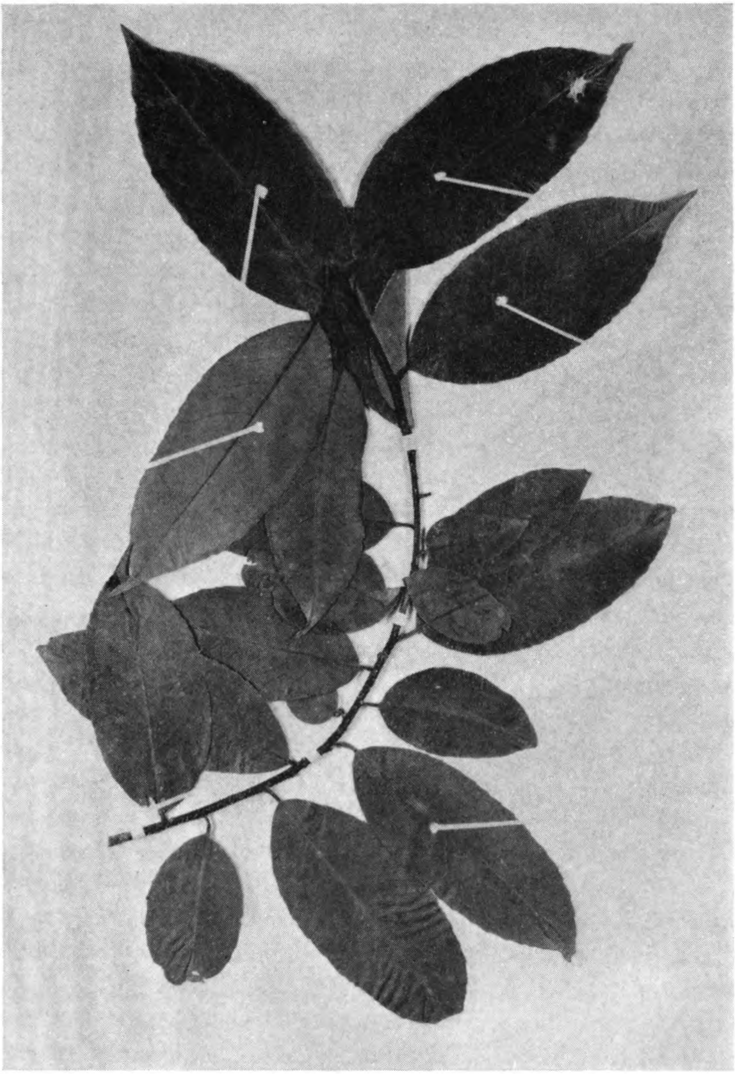
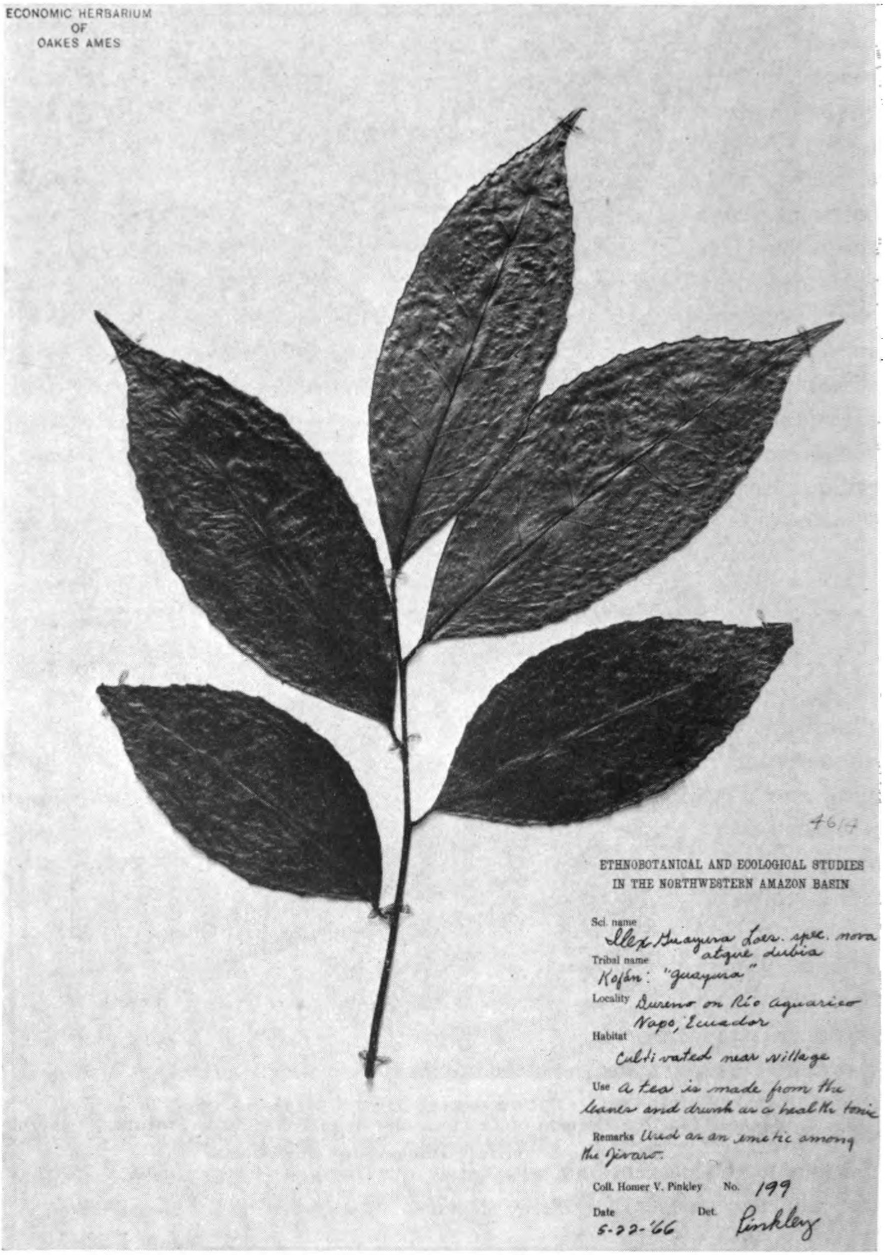


Fig. 4. *Asplund* (*9485*) collection of *Ilex Guayusa* from Tena, Napo-Pastaza, Ecuador. Photograph courtesy Riksmuseet, Stockholm.



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ETHNOBOTANICAL AND ECOLOGICAL STUDIES
IN THE NORTHWESTERN AMAZON BASIN

Sci. name Ilex Guayusa Loes. spec. nova atque dubia

Tribal name Kofán: "guayusa"

Locality Dureno on Río Aguarico Napo, Ecuador

Habitat Cultivated near village

Use a tea is made from the leaves and drunk as a health tonic

Remarks Used as an emetic among the Jivaro.

Coll. Homer V. Pinkley No. 199

Date 5-22-'66 Det. Pinkley

Fig. 5. *Pinkley* (*199*) collection of *Ilex Guayusa* from Dureno, Río Aguarico, Ecuador.

IV.

How extensively does *Ilex Guayusa* occur in northern South America? Collections are so few that we cannot expect to map its distribution wholly from botanical vouchers. By combining modern collections with modern and older reports in the historical and anthropological literature of the use of guayusa, we might outline its present and former area of cultivation as the eastern slopes of the Andes in southernmost Colombia, Ecuador and northernmost Peru. There is no historical record of the plant or its use in the highlands themselves or in the western Andean slopes of these countries.

One significance of the discovery in highland Bolivia of archaeological remains of *Ilex Guayusa* lies in part in the extension southeast of the known area of cultivation and use of the species. Guayusa could not grow at the altitude of the archaeological site. Consequently, the leaves in the tomb must have been imported from a lower, warmer region, probably from the Amazonian slopes of the Bolivian Andes. This suspicion is strengthened by the discovery in the burial also of a leaf of *Duroia* and a capsule of *Cariania*, both of which species occur only in warmer country and are to be expected as elements of the Amazonian regions of Bolivia. The archaeological find, consequently, greatly extends the range of the occurrence and use of *Ilex Guayusa.*

At first impression, it might appear that Bolivia would lie far out of the area of known distribution of *Ilex Guayusa.* Botanical collections, few though they be, would indicate a more northerly Andean range for the species; and it appears definite that the real centre of its cultivation lies on the eastern slopes of the Ecuadorian Andes, especially in Canelos and adjacent valleys.

There are, nevertheless, several considerations that must be borne in mind as we study the distribution and use of guayusa in the light of this archaeological find in Bolivia. First: the archaeological material dates from about 500 A.D., and since, as shown below, the use and cultivation of *Ilex Guayusa* seems actually to be shrinking in extent in the past 300 years, there is every possibility that the plant could have been known and employed much more widely 1600 years ago. Second: it is possible, albeit rather remotely so, that the archaeological leaves represent material of such magical or medicinal importance that they were traded into the area from a great distance. Third: we do have a modern collection from Bolivia which can with little or no hesitation be referred to *Ilex Guayusa.* The collection *B. A. Krukoff's 8th Expedition to South America 11271,* preserved in the Arnold Arboretum, Harvard University, was made in the Departamento La Paz, Provincia Laracaja, Copacabana, about 10 km. south of Mapiri, at an altitude of 850–950 m. (October 8–November 15, 1939); it is said to be a "shrub 45 ft. high". This specimen was originally identified by E. J. Alexander of the New York Botanical Garden as *Ilex amygdalifolia* Rusby, but the specialist on the Aquifoliaceae, Dr. Shiu-Ying Hu of the Arnold Arboretum, has determined the material, which is sterile, as "*I.* cf. *Guayusa*", an identification with which I fully concur. The leaves of this material match in size and coriaceousness most of those in the archaeological find under consideration: both are in general smaller and more rigidly leathery than the typical *Ilex Guayusa* of Ecuador, but these differences may possibly be correlated with the growth of the Ecuadorian material in heavier rain forests with greater shade and rainfall and possibly at somewhat higher elevations than the Bolivian specimens.

V.

One of the most inexplicable shortcomings in modern ethnobotanical knowledge of South America is the dearth of detailed information concerning the use of *Ilex Guayusa*. It is almost equally as puzzling as the scarcity of collections of the plant in our herbaria. That guayusa is still used, and in some regions rather commonly, is attested by the number of references to it and the collections of specially designed pots, called *guayuceros*, which certain tribes of Amazonian Ecuador and Peru make for the brewing and serving of the stimulating drink.

The first and by far the most complete study of guayusa is that of Victor Manuel Patiño (21, 22), who has traced references to the use of the plant from 1683 to the present time.

Three centuries ago, a Jesuit, Padre Juan Lorenzo Lucero, reporting on an expedition into the basin of the Rio Marañon, wrote to the Viceroy of Peru that the fierce Jivaro Indians "... put together these evil herbs [*Datura*, *Banisteriopsis*, and other narcotics] with guañusa and tobacco, also invented by the devil, and allow them to boil until the small remaining quantity of juice becomes the quintessence of evil, and the faith of those who drink it is rewarded by the devil with the fruit of malediction, and always to the great misfortune of many ..." (13). He wrote further that the Jivaros "... were accustomed to drink a decoction of an herb called *guayusa*, similar to laurel, several times daily. They were thus able to stay

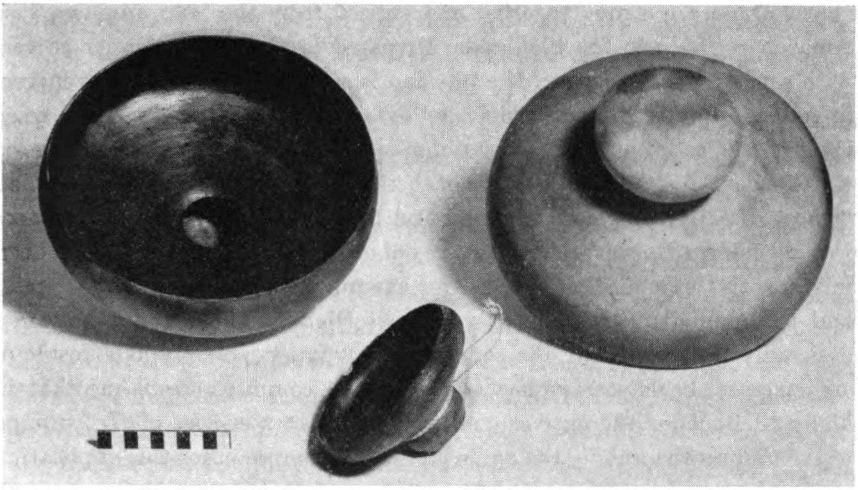

Fig. 6. *Guayuceros* or bowls for preparing and drinking the beverage made from leaves of *Ilex Guayusa*. Mainas Jivaro, Río Macusari, Peru. Courtesy Botanical Museum of Harvard University, Cambridge.

awake without losing consciousness for many nights, when they feared an invasion by their enemies."

Half a century later, in 1738, an Italian missionary working amongst the Maynas of Peru, recorded that, when the priests lacked necessary remedies, they ". . . frequently use [for stomach disorders] the leaves of a plant called *guayusa*, similar to wild laurel" (13). At the same time, in 1739, Padre Andrés de Zarate reported that one product of the Jesuit mission territories was "guayusa, which is an herb that missionaries use in the same way as the tea of the Paraguay herb" (6). The following year, another Jesuit, Padre Juan Magnin (19), described plants used by the natives of Provincia de Maynas in Peru and listed "the guayupa [probably a typographical error] . . ., another beneficial potion which, when boiled, turns the water black as ink, and is found in Borja, Santiago and Archidona." Guayusa was reported in 1785 and again in 1788 as a drink preferred by the Pinches, a tribe inhabiting the Río Pastaza of Ecuador and Peru.

The Jesuits exported guayusa from their missions and sold leaves of it in Quito (five leaves for half a real) (24). An explanation of its value was offered by a missionary writer of the period as follows (32, 33): "*Huayusa*, not a very tall tree with leaves as long and wide as a hand, dentate and thick. These are strung together and carried from the low provinces [the Amazon regions] to the highlands. Prepared in the same manner as tea, with a very agreeable taste, the infusion is said to cure chills and venereal infection. It is also used widely to overcome sterility in women, even though the condition has existed for years." Patiño (21) comments on the excellent business that the sale of these leaves must have been in a region "where dissolute customs prevailed and the incidence of venereal diseases was alarming". He suggests that leaves of other plants might also have been mixed with those of *Ilex Guayusa:* for example, several piperaceous species and the monimiaceous *Siparuna Eggersii* Hieron., all of which have occasionally been called by the same name, *guayusa*, possibly as a result of similar uses. Professor Gunnar Harling (pers. comm.) informs me that in highland Ecuador the natives commonly refer to a species of *Hedyosmum* of the Chloranthaceae by the name guayusa. The reason for this application of the name undoubtedly stems from the use of *Hedyosmum* in the preparation of a stimulating tea. The Indians of the Valle de Sibundoy in adjacent southern Colombia, for example, are accustomed to drink an infusion of the leaves of a species of *Hedyosmum* when travelling or working in the high *páramos* of the region.

Patiño (21) postulates that, when the Jesuits, who had established the use of guayusa in the treatment of venereal disease, were expelled in 1766, the plant fell into disuse in the Ecuadorian highlands. There would seem, however, to be no reason why its employment as a stimulant should have been affected amongst the Indians of the lowlands.

It was reported by a missionary (3) that, in 1853, the Jivaros were cultivating guayusa among other useful plants around their houses. The use of guayusa was thought, in this period, to be confined to the Jivaros and Kanelos of the Ríos Napo and Pastaza.

It was at this time, in 1857, that Richard Spruce encountered guayusa extensively under cultivation amongst these same natives at Antombós, near Baños, in Ecuador. Spruce's report (25) is a most detailed record of guayusa and deserves, therefore, to be quoted in full. I am unable to explain why Spruce failed to make herbarium specimens of *Ilex Guayusa*, unless his reason for neglecting this task was absence of flowers or fruits on the trees which he found. He wrote: "Instead of Cupána or Guaraná [*Paullinia Cupana* HBK.], the Zaparos and Jibaros, who inhabit the eastern side of the Equatorial Andes, have Guayúsa, a plant of very similar properties, but used by them in a totally different way. The Guayúsa is a true Holly [*Ilex*], allied to the maté or Paraguay tea (*Ilex paraguayensis*), but with much larger leaves. I was unable to find it in flower or fruit, and cannot say if it be a described species. The tree is planted near villages, and small clumps of it in the forest on the ascent of the Cordillera indicate deserted Indian sites. The highest point at which I have seen it is at about 5000 feet above the sea, in the gorge of the Pastasa below Baños, on an ancient site called Antombós, a little above a modern cane-farm of the same name. There, in 1857, was a group of Guayúsa trees, supposed to date from before the Conquest, that is, to be considerably over 300 years old. They were not unlike old Holly trees in England, except that the shining leaves were much larger, thinner and unarmed.

"When I travelled overland through the forest of Canelos, and my coffee gave out, I made tea of guayúsa leaves, and found it very palatable. The Jibaros make the infusion so strong that it becomes positively emetic. The guayúsa-pot, carefully covered up, is kept simmering on the fire all night, and when the Indian wakes up in the morning he drinks enough guayúsa to make him vomit, his notion being that if any food remain undigested on the stomach, that organ should be aided to free itself of the encumbrance. Mothers give a strong draught of it, and a feather to tickle the throat with, to male children of very tender age. I rather think its use is tabooed to females of all ages, like caapi on the Uaupés."

An hitherto apparently unpublished Spruce note on guayúsa, preserved at Kew, in a letter to the "Agent of Ecuador Land Company (Mr. G. P. Pritchett) in a reply to enquiries stet the feasibility of forming a colony of Europeans in Forests of Canelos (written at Baños, Dec. 1857)", gives additional information on guayúsa and would seem to support the suspicion that the centre of distribution of the plant was the eastern slopes of the Ecuadorian Andes. "I am not sure that the Guayúsa, which the wild Inds plant near their houses might not successfy compete in the English market against the inferior sorts of Tea. This is the leaf of a sort of holly, perfectly difft from the Maté or Paraguay Tea, tho somewhat allied to it, and it has much the same aromatic flavour without the bitterness of Chinese tea. I have used it for weeks of thogt instead of tea, & I believe you have drunk [?] some."

At about the same time, the Ecuadorian geographer, Villavicencio (34), made similar observations concerning guayusa: "This habit [drinking guayusa every morning] is so widespread among them [the Jivaros] that even the children are given by the mother a fair quantity of the decoction of guayusa, and a feather is used to promote vomiting and accustom them to this practice from early years."

Tessmann (26) has cited the use of guayusa amongst some five tribes of the Amazon of Ecuador and Peru in modern times: Aguano, Auishiri, Chebero, Chivaro, Ikito, Kandoshi, Kanelo, Kashibo, Kichos, Kokama, Koto, Lamisto, Mayoruna, Omagua, Omurana, Panobo, Pintshe, Pioche, Ssabela, Ssimaku, Tshamikuri, Tshayahuita, Yagua, Yameo, Zaparo.

Perhaps the most detailed modern report on the employment of *Ilex Guayusa* is offered by Rafael Karsten (14), the anthropologist who records its contemporary use amongst the Jivaros and the Kanelos. According to Karsten, only males may prepare the guayusa beverage, but it is drunk by adult males and females as well as by children. It is often administered to dogs before the hunt. Guayusa has a ritual significance in the Jivaro Tobacco Ceremony of the Women, when all guests, before they can touch food, ". . . must wash their mouths with a guayusa solution. Both the cooking of the guayusa and the taking of the tonic has the same ceremonial character as other important acts at the feast. A small clay pot . . . is placed on the ground by the women assisted by a priestess. The latter first makes the bride pull off the leaf from the twig and put it down in the *yukunda* [pot]. The same manoeuvre is repeated with the second and third woman. Then the bride . . . pours a little water, first into a gourd, and thereupon into the pot with the guayusa leaves. All three women, assisted by the priestess, now carry the pot cautiously to the fire where it is allowed to boil.

"As soon as the drink has boiled enough, the priestess puts a little of it into a gourd and gives it to the bride to wash the mouth with it. The latter, having washed her mouth, spits out the solution without drinking it. The same is repeated by the other women." Following this ritual the women are ready to eat and to continue with other parts of the ceremony.

Guayusa has an important role in the Victory Festival and the Tsantsa Feast, when the heads of slain enemies are shrunk. On the way back from battle, "they break off some twigs of guayusa . . . called *weisa* by the Jibaros, a tree the leaves of which are used for the preparation of an aromatic and tonic drink, with which the Jibaros wash their mouths every morning. This drink has now to be prepared. The slayer as well as his wife and daughter together grasp a small clay pot . . . pour water into it from a large vessel, and together place it on the fire. As soon as the drink has boiled, the *whuea* [chief of the ceremony] takes a little of it in a small gourd, mutters an incantation over it, and passes it to the slayer who washes his mouth with it without swallowing much of it. Thereafter the *whuea* in the same way gives of the drink to the wife and the daughter of the slayer, who likewise wash their mouths with it. The small clay pot is then taken off the fire and laid aside. The three persons are now properly purified for breaking the fast."

The Jivaros seem also to ascribe certain divinatory importance to guayusa. Karsten reports that just as they "... take certain narcotic drinks when they are preparing for war, to see whether they will be lucky or not in the undertaking, so they also understand a kind of divination in regard to hunting. The drink then used is prepared of the guayusa ..., the leaves of which are boiled in water for the purpose. The guayusa is not a real narcotic but a tonic, to which the Indians ascribe magical purifying effects. The Jibaros, however, seem to believe that the drink produces dreams of divinatory significance or, more strictly speaking, what they call 'small dreams', especially such as have reference to hunting.

"When the Jibaro gets up in the morning, his first act is to place a small clay pot on the fire to prepare his guayusa ..., of which he then takes a small quantity, washing the mouth with the rest. If the liquid in the guayusa pot boils well so that the water whirls round rapidly, the Jibaro thinks that on that day he will have good luck in hunting ... if the guayusa does not boil well, he believes that on that day he will not be able to kill any game. In the dream, the same thing can be 'seen' ..., and this is considered more important. If the Jibaro dreams that he sees his guayusa pot boiling furiously, so that the water whirls round as in a whirlpool, he is convinced that on the following day he will have good luck in killing wild hog, monkeys, birds, and other animals, and the young men in the house are sent out into the forest to look for game.

"In general, the Jibaros have the idea that the guayusa makes the body strong and swift, particularly for hunting. This also explains why the guayusa forms a part of the medicine given the dogs at the feast *Yawapani*."

According to Gill (7), guayusa is extensively employed as a ritual mouth-cleanser amongst the Jivaros: before making curare, ayahuasca (*Banisteriopsis inebrians*) is taken, "a long bitter swallow of the juice of the soul-vine ... and go into your lean-to to sleep with your hunger and dream strange dreams about the magic of curare and the mighty hunting you will do ... Early the next morning, ... you quickly rinse your hunger-tasting mouth with the acrid guayusa and swallow a mouthful of some food which has no salt and chew a bit of sugar cane. By then, you are ready for the actual making."

Although the centre of use of *Ilex Guayusa* in the 18th Century appears to have been the eastern Andean slopes of Ecuador and northern Peru, the plant was recorded from Colombia, somewhat to the north of this area.

A missionary, Padre Juan Serra (24), who worked in the Putumayo-Caquetá region of Colombia from 1756 to 1767, wrote that guayusa was used by the head Franciscan priest, Padre José Berrutieta, at Santa Rosa. In view of the extraordinary detail of Padre Serra's report, it may be worth transcribing it here in full.

"The day after the arrival of the President [head priest], I saw strings being hung out in the patio and hanging from them bundles of leaves. I went into the kitchen and asked their purpose. A woman answered: 'Father, this is guayusa. The President drinks it twice a day, and we have hung it in the sun to dry.' I told her that I would like to try it, and she said that she would give me some in the afternoon. Later . . . I tasted it; but as it was already sweetened, I did not drink more, but told her: 'I do not like it sweet, but unsweetened, in order to discover its true taste.' Later, they brought me more, and I drank a whole cupful. It has the color of dark honey, and five leaves are enough to make a chocolate pot full of its juice. Its taste is like tea but finer and more pleasant. When I drank it, I began to sweat and expectorate so much that I was obliged to change my habit, and within half an hour coughed enough phlegm to fill a large cup. These effects seemed to me to be very good. I went to the President and asked him about guayusa. He said that the beverage was excellent for the treatment of venereal diseases, that it . . . cleansed the blood and improved the digestion and appetite, because, when taken in the morning, one does not feel hunger until the afternoon. It strengthened the body and removed all impurities through perspiration and phlegm. All these effects are true, and I have experienced them many times. Father Berrutieta told me also that guayusa taken with honey caused women to become fertile, and, if the honey was that of the bee called *apate*, the woman, if married, would become pregnant immediately. This fact is well known and proven in Quito and the highlands. The Jesuits brought the plant from their mission and sold it in Quito at five leaves for a half real. I asked him where it might be found, and he told me that in the village of La Concepción, Fr. José Garvo had a big tree, but in Pueblo Viejo, the first town one reaches from here, about four days distant, there is a grove of more than one league in area, entirely of guayusa trees. I at once wrote the name of the village and the name of the tree, in order not to forget them, in order that I might provide myself with supplies for my journey and destination."

When Padre Serra arrived at Pueblo Viejo in December, 1756, he ". . . asked the . . . Mayor about Guayusa. He said that there was a great deal, and that if I so wished he would have some brought, because it grew in the forest somewhat outside the town. I told him that I wanted to go there myself and see the guayusa trees. He said that I could not go, that the mountain growth of brush was dense, but I insisted, and he assigned to me three Indians, each with a machete . . . We took with us two *saparos* or baskets . . . We arrived at the guayusa grove, which is on a plain. The guayusa tree is the most beautiful and luxuriant tree that I have ever seen. It grows to be rather large in girth, so much so that three men could not encircle it, and tall in proportion, with a heavy crown. The trunk is ash-color, like the trunk of the poplar, the leaf a gentle and delightful green. So much so that, seeing it, I considered the hardship of the journey well worth while. From the first tree I came to, I took some leaves and began to eat them to find out their taste. I found that it was very agreeable, somewhat similar to tea, but finer and more pleasant. Seeing that there were many seedlings in the field, while the Indians gathered leaves . . . I . . . cut six internodes of bamboo, and, with the machete, took out eighteen seedlings with roots, placing three in each internode with earth from the same place. I took them with me and, in each village of the Putumayo, I planted three guayusa trees, and they all grew, so that, at the end of three years, they were giving many leaves. In this way, all the priests were provided with guayusa for their own consumption." When Padre Serra finished his stay in Colombia and went to Peru, he took half a hundredweight of guayusa leaves with him, as well as a supply to display in Bogotá and Popayán.

That guayusa was well known in the Colombian Putumayo in those years is attested also by the reports of several Franciscan missionaries who had a mission on the Río Putumayo slightly downstream from its confluence with the Río Sucumbíos (5, 35). "Among the medicinal plants cultivated by our missionaries . . . for the relief of the poor Indians and themselves, the guayusa tree is outstanding. A description of this tree is being sent, at his request, to Don Pedro de Valencia, treasurer of the Royal Mint at Popayán. Its leaves, which are the most valued part of the plant, are eagerly sought in various parts of New Granada by those acquainted with its beneficial properties as a purgative and an aid to digestion".

About a century later, Padre Manuel María Albís (1) wrote about his trips to the Macaguaje Indians along the Ríos Mecaya, Senseya and Caucaya, in the same Putumayo-Caquetá area of Colombia. Of guayusa, he reported that (21) "it is hot and used in poisonings; the burned leaves, when mixed with barley and honey, are given to women suffering amenorrhoea; when boiled and mixed with *yoco*, a caffeine-containing liana [*Paullinia Yoco*

R. E. Schult. et Killip] the preparation is used to cure dysentery; the liquid is used for stomach aches".

Patiño (21) insinuates that guayusa "grows both wild and cultivated." Pinkley (pers. comm.) also believes that the species may grow in a truly wild state, although he has never encountered it outside of cultivation. Except for the vague statement by Padre Serra that "it grew in the forest", I find no evidence in the literature to suggest its occurrence in an undoubtedly wild state. All references indicate that guayusa, when not planted, grows as an escape or vestige of former plantings around abandoned human habitation sites. Patiño further intimates that, since guayusa, according to early reports, grew so prolifically in the Colombian Putumayo-Caquetá region; that, since Padre Serra's experiments in guayusa propagation were so easily successful; and that since, in Pueblo Viejo, there was a grove "more than a league in size"—guayusa might be still found in the area. This, however, is definitely open to grave question.

Ilex Guayusa, together with all knowledge of it, has apparently disappeared from the Colombian Putumayo-Caquetá region. No botanical collections are known from this area. I worked in the area for a year in ethnobotanical investigations in 1941 to 1942, and one of my constant queries concerned guayusa; I failed to find the plant, and no natives knew of any plant of that name employed as a stimulant or medicine. My enquiries amongst the Capuchin missionaries, many of whom were very knowledgeable in the anthropology of the region and some of whom had resided for more than 15 years in the area, uncovered no acquaintance with guayusa. My enquiries amongst the itinerant medicine-men of the Valle de Sibundoy, excellent botanists and cognizant of all medicinal plants of the adjacent lowland areas, likewise led to naught. Other botanists who have worked assiduously in this region—Guillermo Klug, José Cuatrecasas and Hernando García-Barriga—have failed to collect *Ilex Guayusa*. Several of my colleagues and students who have worked more briefly in the Putumayo have never encountered guayusa. Although *Ilex Guayusa* is still used and cultivated in adjacent regions of Ecuador and Peru, I believe that we are justified in stating that it has disappeared completely from, and that no folk-knowledge of it has survived in, the Putumayo-Caquetá portion of the Colombian Amazon.

In the Colombian city of Pasto, however, leaves of *Ilex Guayusa* are still sold under the name guayusa, presumable as a folk-medicine in the native herb market. Pinkley collected a specimen in Pasto in 1966, but the exact provenience of the leaves—whether the Colombian Putumayo or Ecua-

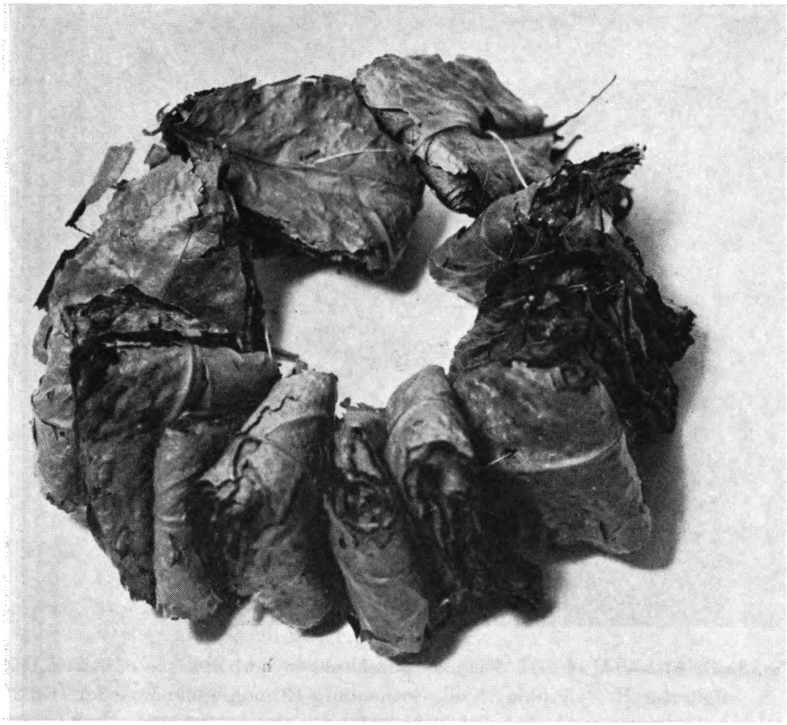

Fig. 7. Ring of *Ilex Guayusa* leaves purchased in herb market, Pasto, Colombia. Collector H. V. Pinkley. Coll. Gothenburg Ethnographic Museum 71.2.1.

dorian territory—has not been ascertained. I would venture to guess that the leaves were imported from nearby Ecuador where, in the herb market in Baños, Pinkley purchased *Ilex* Guayusa in July, 1966, as an "anti-spasmodic". This Pinkley collection from Baños is exceedingly interesting, since the leaves, folded together into a small packet, are strung together in a ring in exactly the same way as done by the 18th Century Jesuits who took guayusa for sale to Quito and the highlands of Ecuador from the warmer lowlands.

This disappearance, within a century or even less, of an important economic plant may seem to be a source of mystery, but it has happened on sundry occasions, and it may be more common than we realize. According to Spruce (25), the guaraná plant, *Paullinia Cupana*, was cultivated all the way up the Rio Negro of the Brazilian Amazon a century ago. I searched

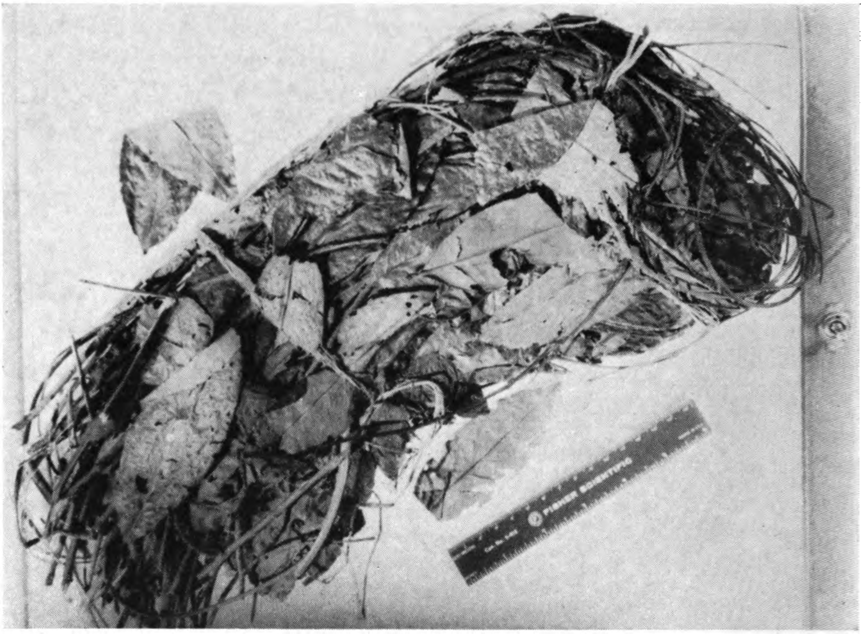

Fig. 8. Dried leaves of *Ilex Guayusa* purchased in herb market of Baños, Ecuador. Collector H. V. Pinkley. Coll. Gothenburg Ethnographic Museum 71.2.2.

for this cultigen on the Rio Negro in 1947 and 1948 and found none, not even escapes from cultivation; and several other modern collectors who have devoted years of botanical study to this interesting region, likewise fail to report it. Spruce, furthermore, stated that the source of an hallucinogenic snuff, *Anadenanthera peregrina* (L.) Speg. (=*Piptadenia peregrina* (L.) Benth.) grew along the Rios Negro and Solimões; modern botanists, a century later, find trees along these rivers so rare that one may assume that the species has, for practical purposes, disappeared from the area. Ethnobotanists, and especially anthropologists, must reevaluate their ideas concerning the rapidity in change of use of plants in primitive societies, above all in those located in the tropical forest areas. Guayusa probably is simply one more example.

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ALKALOID ANALYSES OF BOTANICAL MATERIAL MORE THAN A THOUSAND YEARS OLD

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^{14}C-Determinations were made on the material submitted to us by Henry Wassén of the Ethnographical Museum, Gothenburg, before the leaves and powders were worked up for alkaloid analysis according to the procedure given below. The results are given in table 1. A critical appreciation of the ^{14}C-dating is given by Eskil Hultin (this volume).

TABLE 1

PLANT	FAMILY	CAFFEINE CONTENT	REMARKS
Ilex guayusa No. 70.19.20b	Aquifoliaceae	0.1%	
Ilex guayusa No. 70.19.42–47		1.0%	^{14}C-Dated to A.D. 375
Ilex guayusa No. 70.19.52b		0.2%	
Ilex guayusa No. 70.19.58b		0.4%	
Ilex guayusa Collected at Baños, Ecuador		1.8%	Obtained from Mr. H. V. Pinkley, Botanical Mus., Harvard University, Mass., U.S.A. No. HVP and F.S. 24
Ilex paraguariensis		1.1–1.9%	
Camellia thea	Theaceae	1.5–3.5%	
Coffea arabica	Rubiaceae	1.2%	Ref. 3
Paulinia cupana	Sapindaceae	3–5%	
Theobroma cacao	Sterculiaceae	0.1–0.4%	

MATERIAL AND METHODS

Specimens

Four samples of leaves of *Ilex guayusa* Loes. (Collection numbers of the Ethnographical Museum, Gothenburg, Sweden: 70.19.20b, 70.19.42–47, 70.19.52b, and 70.19.58b.) The leaves were identified by Dr. R. E. Schultes, Botanical Museum, Harvard University, Cambridge, Mass., U.S.A.

Eight samples of powders (Collection numbers of the Ethnographical Museum, Gothenburg, Sweden): *70.19.*2b, 8b, 12d, 13b, 14c, 15d, 16c, and 31b.

^{14}*C-Determinations*

The determinations were performed in the Laboratory for Radioactive Dating, S-104 05 Stockholm 50 on 7 g of leaves, sample numbers 70.19.42–47 and 70.19.20 b. Numbers of analysis: St 3439 and St 3440.

Isolation of alkaloids

Method 1. The powdered leaves (2–5 g) were extracted with methanol. The dried extract was treated according to a procedure used by Fish *et al.* (1) for the isolation of tryptamine derivatives.

Method 2. The powdered leaves (2–5 g) and 25 ml. of water were boiled gently for 15 min. while stirring. After filtration, the residue was washed with 25 ml. of boiling water. A solution of lead subacetate in water was carefully added to the combined water extract until complete precipitation whereafter the mixture was heated to boiling and filtered. The filter was washed twice with 10 ml. of boiling water. Excess Pb^{+2} was precipitated by the addition of 2N sulphuric acid and the water extract was purified with activated charcoal. The mixture was evaporated under reduced pressure to about 10 ml. and filtered while still hot. The water extract was cooled and extracted 3 times with 10 ml. of chloroform. The combined chloroform extracts were dried with anhydrous sodium sulphate, filtered and evaporated to dryness under reduced pressure.

Gas chromatography

Gas chromatographic analyses were performed with an F and M Model 400 equipped with a hydrogen flame ionization detection system. A 2 m × 2.6 mm (i.d.) glass column was silanized, packed with 5% OV-17 (Applied Science Laboratories, State College, Pa.), coated on Varaport-30, 100/120 mesh (Varian Aerograph, Walnut Creek, Cal.). Analyses were made at a column temperature of 190° with a nitrogen carrier gas flow rate of 25 ml.

per min. The vaporizer and detector temperatures were 250°. The amounts of alkaloids were determined by planimetry using caffeine as a standard.

Gas chromatography—mass spectrometry

An LKB model 9000 gas chromatograph—mass spectrometer (LKB Produkter, Bromma, Sweden) was used to confirm the structure of the alkaloid that was found. The separations were made on a 1.6 m × 2 mm (i.d.) silanized glass column, packed with 3% OV-17 on Varaport -30 100/120 mesh maintained at a temperature of 200°. The flow rate of helium carrier gas was 20 ml. per min. The ionizing potential and trap current were 70 eV and 60 μA, respectively, and the ion source was kept at 250°.

Thin-layer chromatography

Alkaloidal constituents were separated by thin-layer chromatography on precoated Silica Gel G plastic sheets (E. Merck AG, Darmstadt) with methanol-glacial acetic acid—water (75:10:15) as solvent. Alkaloids were located with iodoplatinate reagent.

RESULTS

Since snuffing tubes and other parafernalia similar to those used by modern Indians were present in the collection, our first thought was that the leaves and powders might contain psychotomimetic phenolic amines. Therefore, the general work-up procedure according to Fish *et al.* (1) was employed (Method 1). All of the powders proved to be void of alkaloids. The extracts of the leaves, however, gave a single iodoplatinate-positive spot on thin-layer chromatogram (Rf=0.6). First programmed and finally isothermal gas chromatography of these extracts gave one main component (Fig. 1). A mass spectrum recorded of this peak showed the fragmentation pattern in fig. 2, upper panel, which could immediately be identified as that of caffeine (2). Subsequently, the extraction procedure was therefore changed to suit material containing caffeine better (Method 2).

The amount of caffeine in the leaves found has been tabulated together with a newly collected specimen of *Ilex guayusa* and some other well-known caffeine containing plants in table 1. By comparison, the caffeine content in the old sample of leaves from *Ilex guayusa* has stood up well against time.

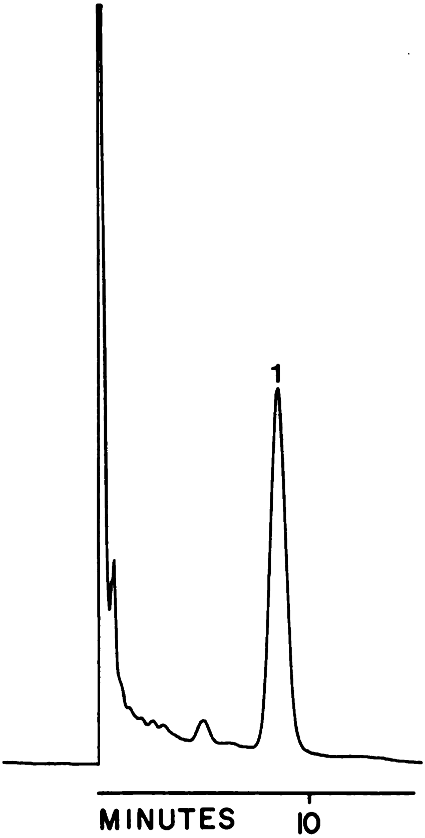

Fig. 1. Gas chromatographic analysis of extract from leaves of *Ilex guayusa* (Collection no. 70.19.42–47).

Conditions: see Materials and Methods.

We do not know the origin of the various powders analyzed. Regardless of their origin it is not surprising that the greater surface area of the powders after such a long time should have caused the destruction of any alkaloids present.

To our knowledge, the finding and quantitation of caffeine in the leaves from *Ilex guayusa* ^{14}C-dated to the fourth century represents results from the oldest material ever submitted to an alkaloid analysis.

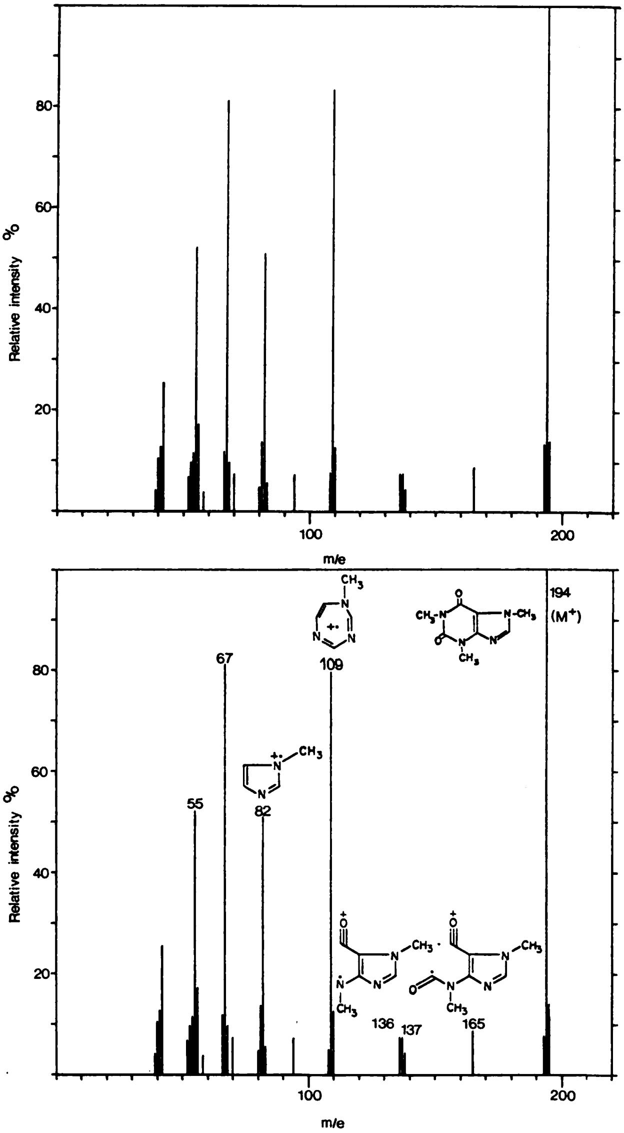

Fig. 2. Mass spectra and fragmentation pattern for (upper panel) major peak in extract from leaves of *Ilex guayusa* (Collection no. 70.19.42–47) and (lower panel) reference compound.

Conditions: see Materials and Methods.

ACKNOWLEDGEMENTS

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ANTHROPOLOGICAL INVESTIGATION OF AN ARTIFICIALLY DEFORMED AND TREPANNED CRANIUM FROM NIÑO KORIN, LA PAZ, BOLIVIA

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INTRODUCTION

The remarkable findings in the Department of La Paz in the Bolivian Highlands of a medicine-man's drugs and implements, also include a cranium. The discovery was made in June 1970, and the skull is now registered at the Gothenburg Ethnographical Museum as Coll.No. 70.19.48. The age of this cranium has been investigated by the Laboratory for Radioactive Dating, Stockholm, using the C14 determination method, and the result was A.D. 755. The radiocarbon dating is discussed by Wassén (p. 28) and in another article in this volume (Hultin, p. 185). The cranium has been made available to me for an anthropological investigation.

METHODS

The measuring technique used was devised by Martin (1928). Moreover, considering the actual artificial deformation of the cranium, it has proved necessary to make measurements not performed by Martin. The results are given in Table 1. In the diagram construction, fig. 5, the Frankfort plane has been geometrically represented according to a method developed by the present author with co-workers (Edlén, Hjortsjö and Lindh, 1947). The anthropological characteristics have been indicated in accordance with principles previously reported by the author (Hjortsjö 1947a and b).

TABLE 1. MEASUREMENTS AND INDICES

The measurements are given in mm, capacity in ml. The numbering in parentheses agrees with Martin's numbering for anthropological measurements.

Capacity (38)	1320
Max. length (1)	167
Glabella-lambda length (3)	167
Glabella-inion length (2)	162
Nasion-inion length (2a)	155
Nasion-bregma length (29)	117
Bregma-lambda length (30)	108
Lambda-opisthion length (31)	94
Nasion-basion length (5)	96
Basion-lambda length (—)	116
Max. breadth (8)	131
Ant. frontal width (9)	86
Post. frontal width (10)	108
Auricular width (11)	123
Asterion width (12)	106
Mastoid width (13)	105
Basion-bregma height (17)	145
Height of ears=EH (20)	129
Length of foramen magnum (7)	35
Width of foramen magnum (16)	29
Basion-prosthion length (40)	94
Nasion-prosthion height (48)	67
Frontomal. temp. width (43)	100
Frontomal. orb. width (43.1)	91
Ectoconchion width (44)	91
Post. maxillofront. width (49)	22
Ant. maxillofront. width (50)	19
Cheek-curve width (45)	133
Maxillar width (46)	104
Width of nose (54)	22
Height of nose (55)	48
Right orbital width (51)	39
Left orbital width (51)	39
Right orbital height (52)	35
Left orbital height (52)	35
Length of palate (62)	48
Width of palate (63)	40
Height of palate (64)	18
Horizontal dimension (23)	477

Transversal dimension (24)	330
Nasion-bregma arch (26)	129
Bregma-lambda arch (27)	125
Lambda-opisthion arch (28)	104
Total longitudinal arch (25)	358
Angles	
Facial angle (72)	87
Angles of the facial triangle:	
Basion angle (72.5)	41
Nasion angle (72.5)	68
Prosthion angle (72.5)	71
Central angle (Klaatsch)	94
Clivus-horiz. angle (35)	64
Clivus-vert. angle (Falkenburger)	14
Indices	
Length-breadth index (8:1)	78.44
Length-height index (17:1)	86.83
Breadth-height index (17:8)	110.69
Length-EH index (20:1)	77.25
Breadth-EH index (20:8)	98.47
Frontal curve index (29:26)	90.70
Parietal curve index (30:27)	86.40
Occipital curve index (31:28)	90.38
Frontal index (9:10)	79.63
Parieto-frontal index (9:8)	65.65
Upper face length-breadth index (45:40)	141.49
Upper face length-height index (48:40)	71.28
Upper face breadth-height index (48:45)	50.38
Right and left orb. index (52:51)	89.74
Interorbital index la (50:44)	20.88
Interorbital index 1b (49:43.1)	24.18
Nasal index (54:55)	45.83
Width-length I of palate (63:62)	83.33
Foramen magnum index (16:7)	82.86

DESCRIPTION OF THE CRANIUM

General characteristics: The cranium has a yellowish-brown colour with unevenly spread dirty brown blotches. On the skull roof there are 3 foramina arisen in connection with trepanations performed *intra vitam.* Furthermore, the cranium has been exposed to artificial deformation. Here and there, remainders of some preserved soft parts, particularly in the zygomatic regions, can be observed. The cranium is exceedingly well preserved, and no traces whatsoever of posthumous damage are to be found. The lower jaw is missing.

The cranium is of average size and rather solidly built. This fact in conjunction with the good sculpturing of the bone surfaces as well as the finely developed cristae and facies musculares suggest with certainty the sex to be male.

The sutures between the skull top bones are everywhere open which suggests an age under 30 years. The synchondrosis sphenooccipitalis on the skull base, which is so important for determining the age, is, on the contrary, just ossified which, in its turn, indicates that the dead person had reached the age of 25. In his lifetime he has had a complete set of teeth in the upper jaw, *i.e.* also molares III (wisdom teeth) have been fully developed. *Post mortem,* all the incisors and the two hindmost premolares have been lost. Only the two front molares show a distinct abrasion. There are no caries defects. With the guidance of the teeth and the suture condition, the age of the person may consequently be estimated at between 25–30 years.

Norma verticalis (fig. 1f): The skull contour is regular, symmetrical and almost sphenoidal. Neither tubera frontalia nor tubera parietalia are well developed. On the other hand, the glabellar region is distinctly prominent.

Norma occipitalis (fig. 1d): From this view the cranium is high and narrow and has an evenly curved upper contour combining the high, in principle vertically placed, side contours. These run down in ordinarily developed processus mastoidei. The side contours are, however, not quite straight but each one shows a slight curving inwards corresponding to a small impression in the lower, hind part of os parietale. This impression is most prominent when the cranium is viewed sideways from behind (see the special picture in fig. 2) and may undoubtedly be interpreted as a straight furrow arisen in connection with an artificial deformation through fillets. Protuberantia occipitalis externa is broadways strongly increased

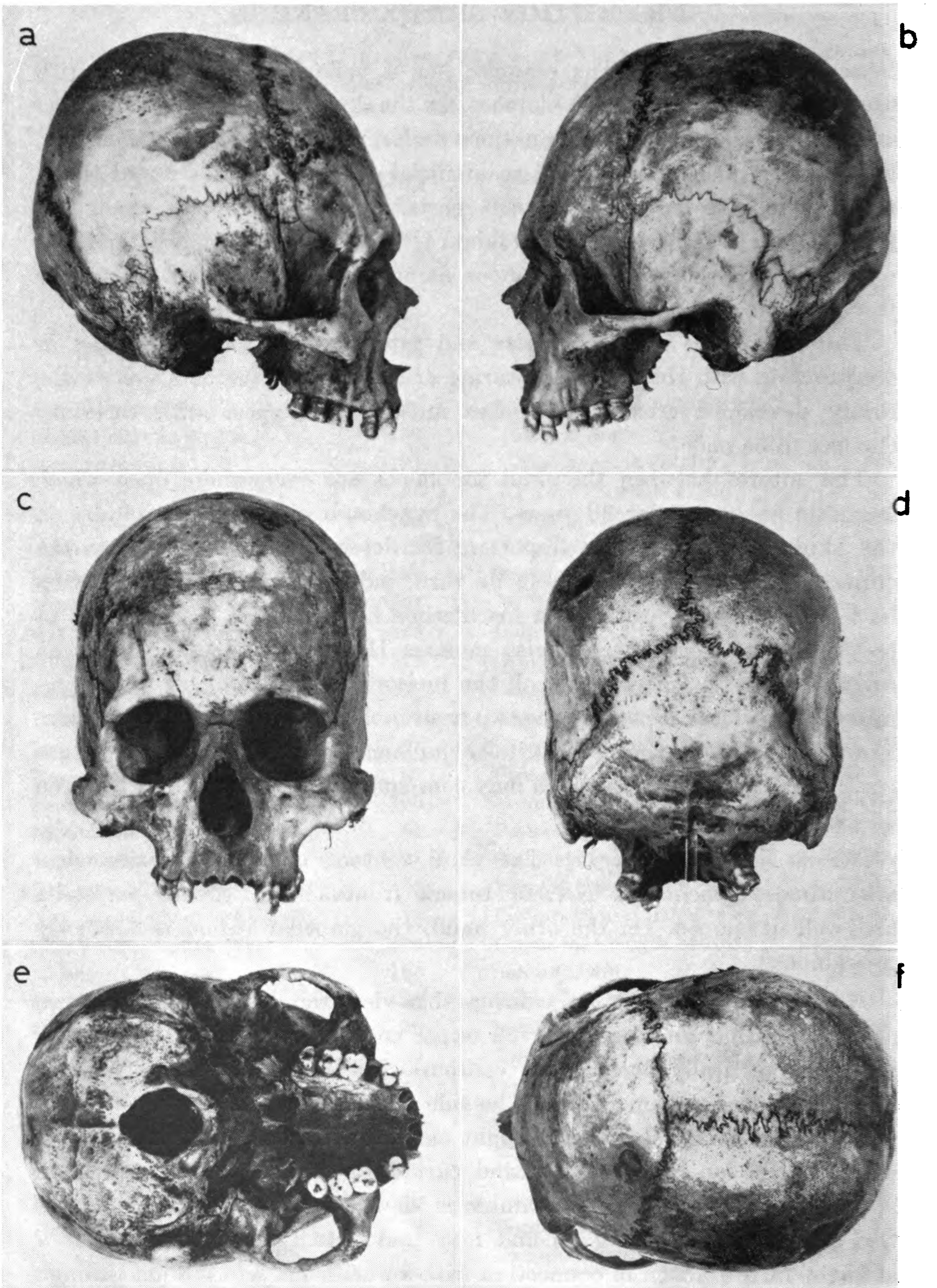

Fig. 1. The skull in different normas. Scale 1: 3.5.

a. Norma lateralis dxt.
b. Norma lateralis sin.
c. Norma facialis.
d. Norma occipitalis.
e. Norma basalis.
f. Norma verticalis.

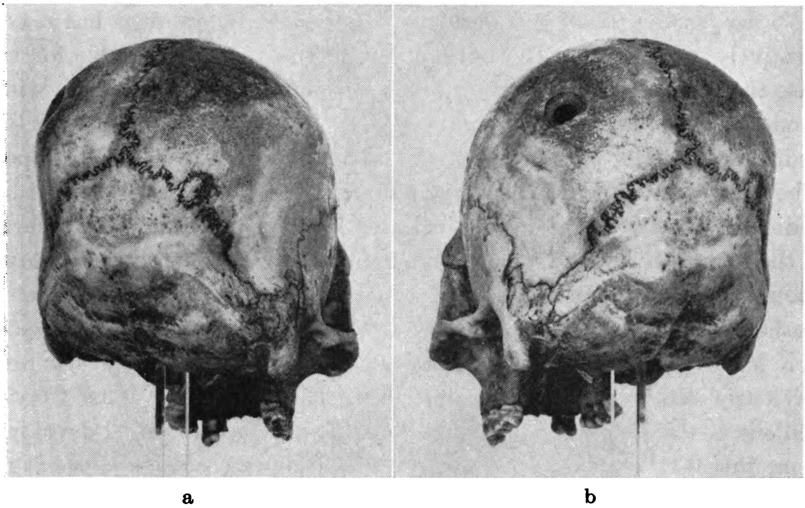

Fig. 2. The skull photographed sideways from the back and from the right (a) and from the left (b) to demonstrate the impression in the lower back part of os parietale.

but otherwise not particularly well marked. The sculpturing of planum nuchale is, on the other hand, rather conspicuous. The right alveolar arcade stands very much higher than the left one and seems pushed upwards (see below).

Norma lateralis (fig. 1 a and b): The cranium is strikingly high in proportion to its length. From a strongly pronounced nasal root dented beneath a very prominent glabella, curva sagittalis rises upwards over a strongly retiring and flattened forehead. Sulcus supraglabellaris is merely suggested. There is a distinct retrocoronal clinocephaly which reaches rather far down the sides. Thereafter, curva sagittalis continues fairly regularly down to opisthion. Consequently, there is no tendency to bathrocephaly and neither is occiput conversely flattened. Vertex is reached approx. 4 cm behind bregma. Protuberantia occipitalis externa is scarcely marked. Linea temporalis is on both sides fairly well pronounced except in its back parts located in the lower parietal region, *i.e.* at the place of the abovementioned slight impression. Meatus acustici have normal width and are free from exostoses. Processus mastoidei are of ordinary size but remarkably broad and blunt in their lower parts. The facial skeleton is powerfully formed. It is not prominent and has an insignificant depth in relation to its height. The nasal root has a slight S-form, and spina nasalis anterior is protracted forwards to a sharp tip.

Norma facialis (fig. 1c): Considering its width the cranium has a comparatively great height. The brain crane, however, is accountable for this, since the facial skeleton is rather low in relation to the cheek curve width. If one disregards the bulging glabella and the arcus superciliares in their medial parts clearly marked out, the whole of the frontal region appears to be flattened. In the glabellar region there is a small rest of sutura frontalis media. Of the two foramina or incisures in margo supraorbitalis there is on the left side only one represented, incisura frontalis medialis (for ramus medialis of nervus frontalis, and corresponding artery). This must be considered as a normal anatomical variation. On the right side, however, there is a variation in the anatomical structure which the author has never previously observed or found described. There is an incisura frontalis medialis of the same kind as on the left side although less well developed. From this incisura a fine bone canal runs sideways upwards passing to approx. 15 mm above margo supraorbitalis. The anterior wall of the canal is partly defect, and on the front side of the bone, a fine, for the most part not obliterated, suture indicates the course of the canal (see the special picture in fig. 3; a fine straw has been brought through the canal). On the right side there is also a foramen frontale laterale (for ramus lateralis of nervus frontalis, and corresponding artery). It is, however, located not less than 10 mm above margo supraorbitalis, and from the foramen a 2 mm wide and 35 mm long, sharply demarcated furrow rises upwards-backwards on the lateral lower part of squama ossis frontalis. Ramus lateralis of nervus frontalis (or corresponding artery) has thus continued its ascending course in this furrow (see the special picture in fig. 3; a piece of wire has been passed through the canal). It can not be but assumed that both ramus medialis and ramus lateralis of nervus frontalis (and corresponding arteries) have brought about deep canals in the bone tissue, which thereafter have partially been transformed into bone canals. The manifestation described above can of course be a unique phenomenon in the asymmetrical structure of many of the skull details. But a purely hypothetical explanation of the find may also be that the pressure of a fillet in connection with an artificial deformation can be the cause. Processus zygomatici ossis frontalis shoot beak-like downwards-outwards, and the difference between the smallest anterior frontal width and the width between the two frontomalaria temporalia—14 mm—is therefore considerable. It appears not improbable, though, that also the smallest anterior frontal width has been reduced through artificial deformation. The zygomatic arches are bending outwards, contributing to the large facial width.

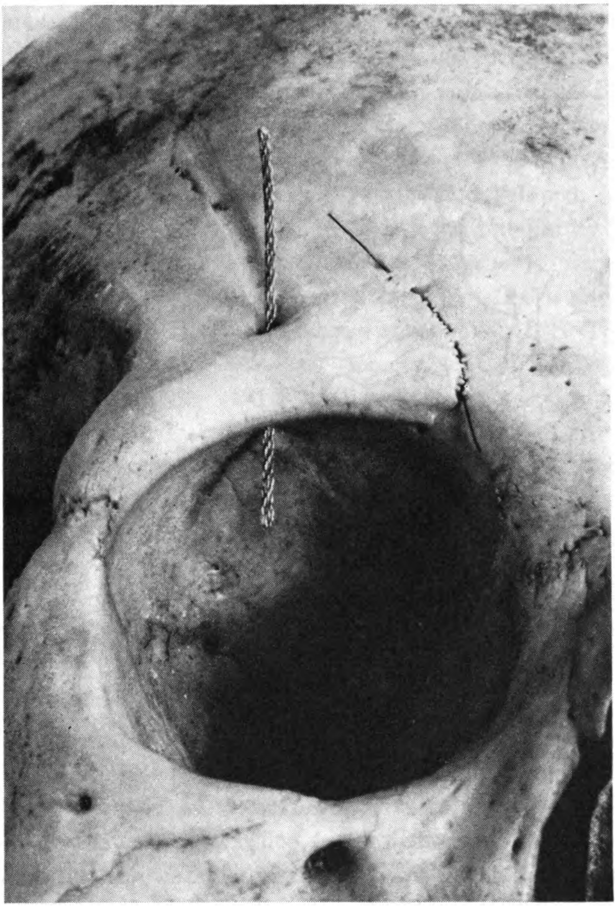

Fig. 3. Margo supraorbitalis dxt with canals for ramus medialis and ramus lateralis of nervus frontalis (and corresponding arteries).

The orbital openings are symmetrical, distinctly demarcated, nearly square-shaped with rounded corners and slightly oblique—placed in such a way that their medially drawn out X-axes form a downwards open angle. The nasal root is of ordinary width while the sharply demarcated nasal opening is high and narrow. The floor of the nasal cavity stands much higher on the right side than on the left. To judge by the appearance and the position of crista nasalis there has been a considerable deviation to the left of septum nasi. The powerful, pointed spina nasalis anterior has,

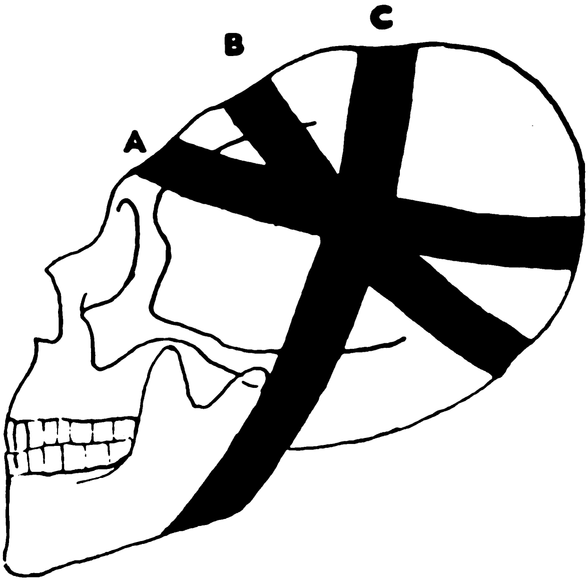

Fig. 4. A schematic figure showing the hypothetic application of the deforming fillets. (According to Backman, 1919.)

however, not been affected by it. The ossa nasalia resemble the form of a sand-glass and are connected arcade-like to a nasal bridge which in its upper section is concave, in its lower, convex. The jaw parts are fairly vigorous with well-marked juga alveolaria, particularly for the canini and the anterior molares. Foramina infraorbitalia are of normal size and somewhat asymmetrical. No fossae caninae are developed. The right alveolar arcade stands higher than the left.

Norma basalis (fig. 1 e): The sphenoidal form mentioned in norma verticalis recurs, of course, also in this view. In relation to its width, the facial skeleton is of very insignificant depth. The palate, surrounded by a paraboloid alveolar arcade, is highly asymmetrical. Particularly in its back sections the palate roof stands considerably higher on the right side than on the left, and the right lamina medialis of processus pterygoideus is 6–7 mm shorter than the left. The author cannot, however, take any standpoint as to whether the abovementioned striking palate asymmetry may be the result of an uneven pressure from below in connection with an artificial deformation (see fig. 4, fillet c. under the angulus mandibulae)—particularly as the lower jaw has not been available for investigation whether a simultaneous deformation of it has occurred. Foramina palatina and foramen incisivum are all large, and spinae et ruga in the palate roof are well developed. The general proportions of the palate are ordinary. The angle between clivus and planum nuchale is, on the other hand, clearly reduced on account of the artificial deformation. Foramen magnum is long and narrow and the occipital condyles are well developed. The venous emissary behind the right occipital condyle is large but hardly noticeable on the left side whereas foramina jugularia are congruent.

Anthropological characteristics (*ad modum* Hjortsjö, 1947a and b): euencephalic, mesocephalic, strongly brachyhypsicephalic (L-H I), strongly stenohypsicephalic (B-H I), strongly brachyhypsicephalic (L-EH I), strongly stenohypsicephalic (B-EH I), spherometopic, stenometopic, strongly brachyeuryfacial, orthofacial, eurychamaefacial, hypsiorbital, hypsistenorrhine, mesostaphyline, orthognathous and having retrocoronal clinocephaly. The cranium has been exposed to artificial deformation and 3 trepanation openings in the skull roof can be observed.

ARTIFICIAL DEFORMATION

The cranium described above is anthropologically-ethnologically in close conformity to the group of 13 skulls, previously brought home by Dr Stig Rydén from various places in the Bolivian Highlands around the Titicaca lake. These regions are thus in close neighbourhood with the now actual locality, Niño Korin, but their archaeological age is much younger. In connection with the anthropological investigation of the aforementioned 13 skulls (Hjortsjö and Lindh, 1947) the artificial deformation has been, in principle, discussed against the background of observations made by, *i.a.* Gosse (1855), Topinard (1879, Hrdlička (1912), Backman (1919), Imbelloni (1930), Aichel (1933) and Falkenburger (1938). Furthermore, a theoretical analysis has been made in order to prove in what way artificial cranial deformations of different kinds affect the cranial dimensions and, above all, certain anthropological angles. Reference is therefore made to this original work and the author will here confine himself to state that the cranium now investigated shows a typical deformation fronto-sincipito-parietalis, *i.e.* an artificial deformation caused by fillets applied around the head. It is possible that this has been done in the way hypothetically suggested by Backman (see fig. 4). Other names for this type of deformation is "*Aymara*" (Hrdlička), "*deformación circumferencial*" (Imbelloni) and

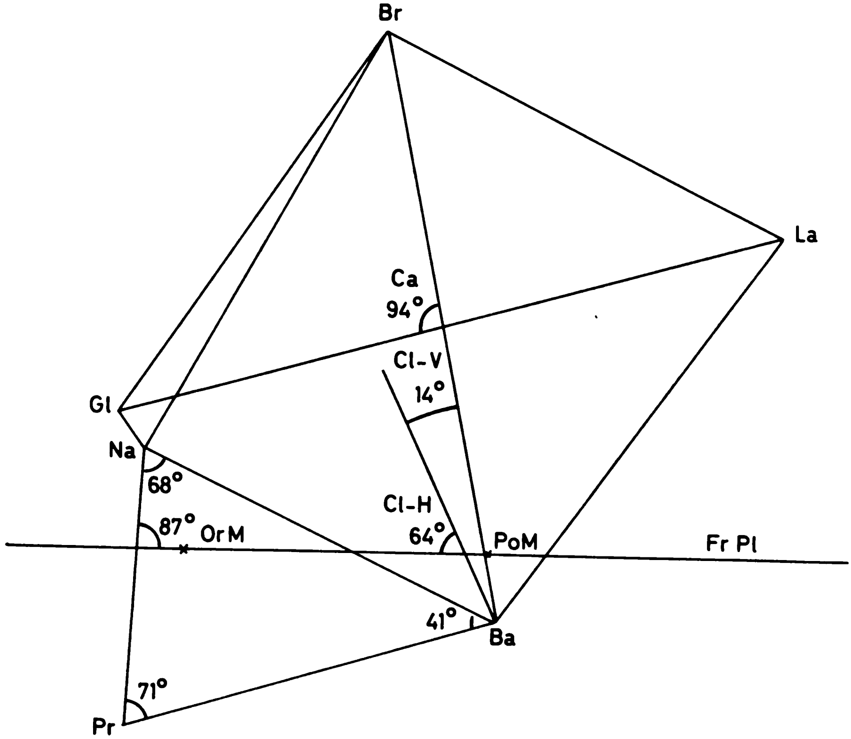

Fig. 5. Median diagram of the skull.

Gl = Glabella
Br = Bregma
La = Lambda
Ba = Basion
Pr = Prosthion
Na = Nasion

OrM = Orbitale medianum
PoM = Porion medianum
Fr Pl = Frankfort plane
Ca = Central angle
Cl-V = Clivus-vertical angle
Cl-H = Clivus-horizontal angle

"*deformatio circularis*" (Aichel, Falkenburger). Two important subgroups are, nevertheless, to be noted:

a) the lambda type, also called "*dressée*" (Topinard), "*erecta*" (Imbelloni) and "*droite*" (Falkenburger);

b) the inion type, also called "*couchée*" (Topinard), "*oblicua*" (Imbelloni) and "*oblique*" (Falkenburger).

The high value of the length-height index of the present cranium suggests *a priori* that the deformation is of the lambda type. That this is the case can, however, also be proved in another way. As has already been shown by

Falkenburger, the central angle, the clivus-vertical angle and the clivus-horizontal angle are in different ways affected by the two types. The angles mentioned can be seen in the diagram constructed for our cranium (fig. 5). Falkenburger found thus,

that the central angle in 92% of the lambda type varied between 87–95° and in 91% of the inion type between 95–102°; in the present case the value is 94°;

that the clivus-vertical angle in 100% of the lambda type varied between 16–29° and in 100% of the inion type between 29–44°; in the present case the value is only 14°;

that the clivus-horizontal angle in 98% of the lambda type varied between 57–66° and in 92% of the inion type between 50–56°; in the present case the value is 64°.

TREPANATIONS

As previously stated, the cranium shows 3 trepanation openings, all of them on the left side of the skull roof. The openings can be seen in norma verticalis (fig. 1f) but also in special pictures (fig. 6). The frontal trepanation opening, here called trepanatio frontalis, is located in the upper part of squama ossis frontalis, approx. 1 cm in front of sutura coronalis and approx. 2 cm to the left of the median line. The two other openings, here called trepanatio parietalis ant. and post., respectively, are located within the central section of os parietale sin., approx. 6 cm from the median line and approx. 2.5 cm from each other. In their great material of trepanated skulls, Graña, Rocca and Graña (1954) found likewise that most trepanation openings were located within the left *os parietale.*

Trepanatio parietalis post.: The opening is circle round and crater-like with a diameter in the tabula externa (the outer diameter) being approx. 17–18 mm and in the tabula interna (the inner diameter) being approx. 10 mm. The rim around the exterior opening is partly rather sharp but in other sections somewhat rounded on account of a commencing bone healing or bone reaction. In a zone up to 1 cm wide around the opening, the tabula externa is without any doubt scraped with a sharp-edged object which has been moved tangentially against the skull wall since remainders of marks from scratching or cutting can be noticed here. Probably due to a bone reaction this zone has been slightly elevated. Consequently, various signs indicate that this trepanation was made a short or a long time before the

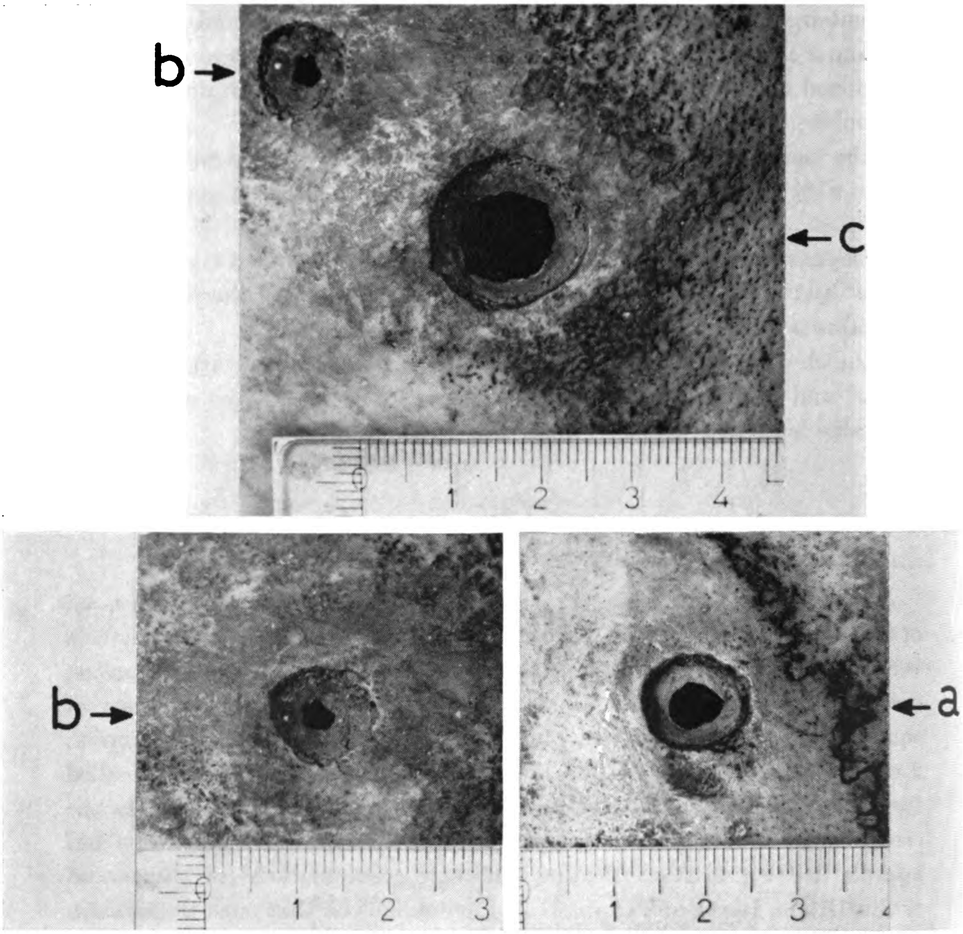

Fig. 6. The trepanations.

a. Trepanatio frontalis

b. Trepanatio parietalis ant.

c. Trepanatio parietalis post.

person's death. Only after the zone was scraped (to make the skull wall thinner? to remove the soft parts?) the trepanation was completed, probably through drilling.

Trepanatio parietalis ant.: As is the case with the above trepanation, this second one is also crater-like but the circle is not so handsomely performed. It is also much smaller. Its outer diameter is hence only approx. 12 mm, its inner approx. 4 mm. The rim is somewhat uneven and shows signs of commencing bone healing or bone reaction. Thus, this trepanation has also been made a short or a long time before death. Here also, as in the first case, signs of scraping can be seen around the trepanation. The scraping seems, however, to have been more intense here, resulting in a slight depression of the zone nearest the opening and obviously making the skull wall thinner. After the scraping the trepanation was completed, no doubt through drilling.

Trepanatio frontalis: The view of this trepanation shows a handsomely drilled crater-like opening made before death in a fairly thick skull wall. Its outer diameter is appr. 11–12 mm, its inner appr. 5–6 mm. The rims are only a trifle rounded but a commencing bone healing or bone reaction seems nevertheless to have taken place. Also in this case numerous cutting or scraping marks can be seen in the zone nearest to the opening. These marks are all superficial and have not made the skull wall thinner.

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TEXTILE FIBRES IN ARCHAEOLOGICAL MATERIAL FROM A TIAHUANACOID TOMB IN BOLIVIA

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Some of the textile objects in an archaeological find of Tiahuanacoid character in Bolivia have been examined in order to determine the origins of the textile fibres.

The objects examined were:
Sample 1: GEM (for Gothenburg Ethnographic Museum)
Coll. No. 70.19.20*a*, from the fabric of a woven bag.
Sample 2: GEM Coll. No. 70.19.20*a*, from the embroidery of the same bag.
Sample 3: GEM Coll. No. 70.19.11, from a woven ribbon.
Sample 4: GEM Coll. No. 70.19.10, from a woven ribbon.
Sample 5: GEM Coll. No. 70.19.8*a*, from a skin pouch.

Fibres taken from each sample were studied in a light microscope and in a scanning electron microscope.

All the samples were found to consist of animal fibres. Having conferred with Dr. S. H. Wassén, Gothenburg Ethnographic Museum, we tried to assign the fibres to either alpaca or vicuña.

The fibre properties observed and the characteristics of alpaca and vicuña wool (1) have been put together in Table I. Guided hereby and by the figures I–XIX we concluded that the samples 1, 4 and 5 derive from alpaca. In the samples 2 and 3 properties of alpaca as well as of vicuña appear and these samples are likely to contain both the fibres in question.

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1. R. D. MORRISON, American Dyestuff Reporter, Oct. 28, 1963, p. 30, p. 36.

TABLE I

Properties of fibres from samples 1–5. Properties of fibres of alpaca and vicuña.

Sample	Longitudinal						Cross-section			Fineness	Indicates
	Epidermis	Fig.	Medulla			Fig.	Contour	Medulla	Fig.		
			Occurrence	Type	Size						
1	Faint Imbricate	III, IV	Usually present	Continuous, interrupted	¼–½ d	I	Round-oval-elongated	Oval-elongated-kidney	II	15–50μ	Alpaca
2	Pronounced Coronal	VII	Usually-seldom present	Continuous, interrupted	¼–½ d	V	Round-oval	Round-oval	VI	10–40μ	Alpaca + vicuña
3	Faint Imbricate ?	X, XI	Seldom present	Fragmental	¼–½ d	VIII	Round-oval	Oval-elongated	IX	10–40μ	Alpaca + vicuña
4	Faint-pronounced Imbricate	XIV, XV	Usually present	Continuous, interrupted	¼–½ d	XII	Round-oval	Round-oval	XIII	15–50μ	Alpaca
5	Faint-pronounced Imbricate	XVIII, XIX	Usually present	Continuous, interrupted	¼–½ d, > ½ d	XVI	Oval-elongated	Oval-elongated	XVII	15–50μ	Alpaca
Alpaca	Faint Imbricate		Usually present	Continuous, interrupted, fragmental	¼–½ d	see (1)	Oval-elongated-kidney	Oval-elongated-kidney	see (1)	10–50μ	
Vicuña	Faint Coronal		Seldom present	Fragmental, interrupted	< ¼ d	see (1)	Round-oval	Round-oval	see (1)	6–25μ	

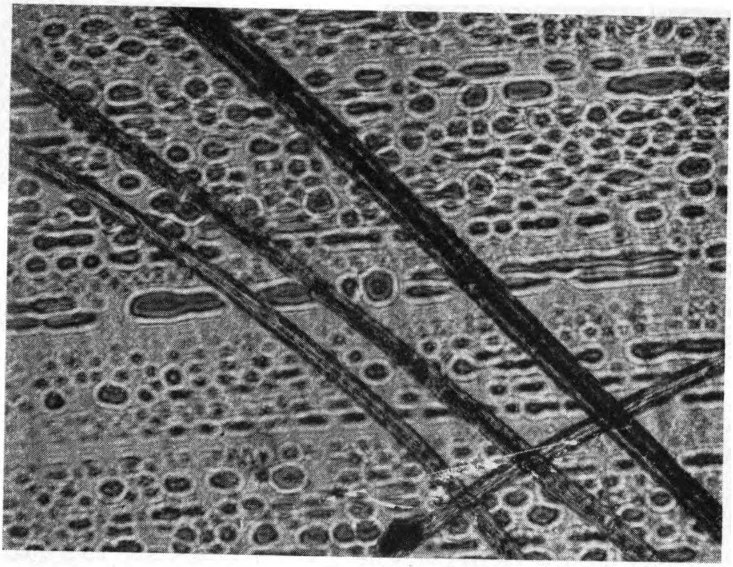

Fig. I. × 125

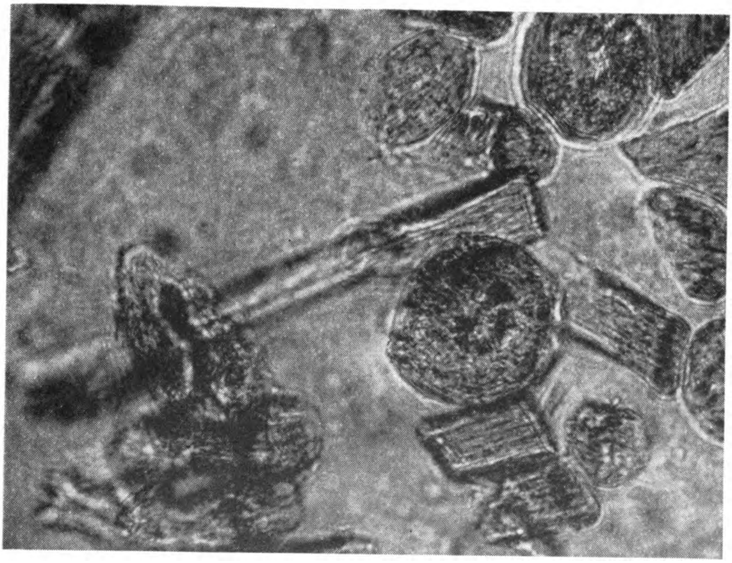

Fig. II. × 500

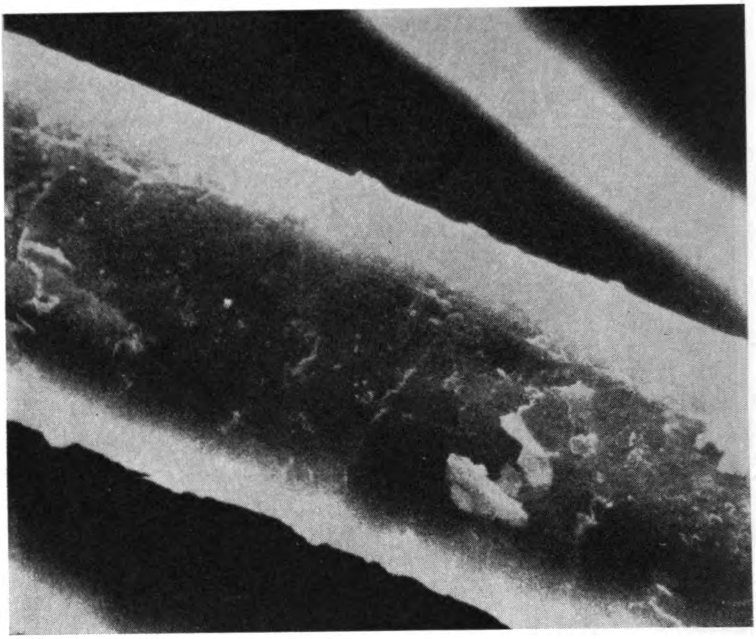

Fig. III. ×2000

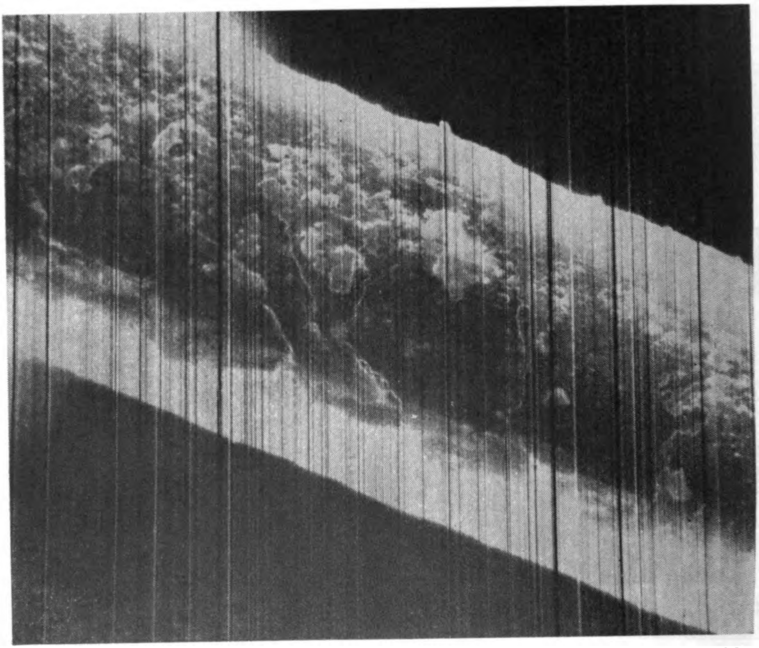

Fig. IV. ×2000

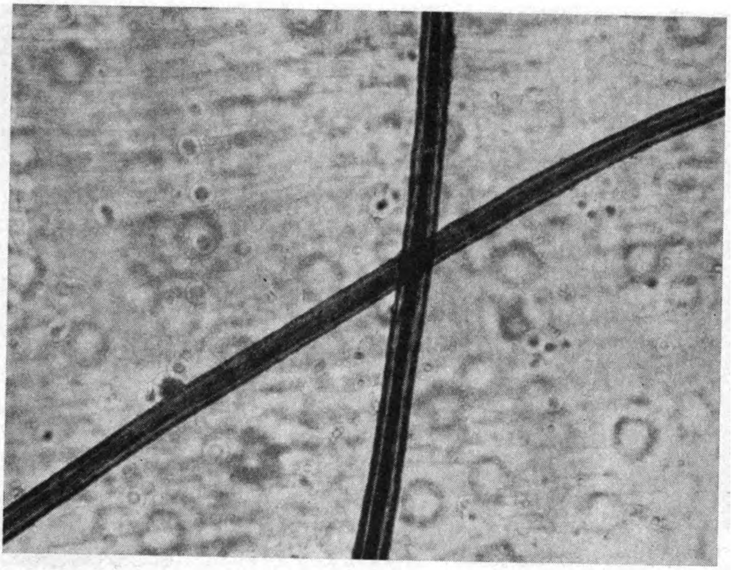

Fig. V. ×125

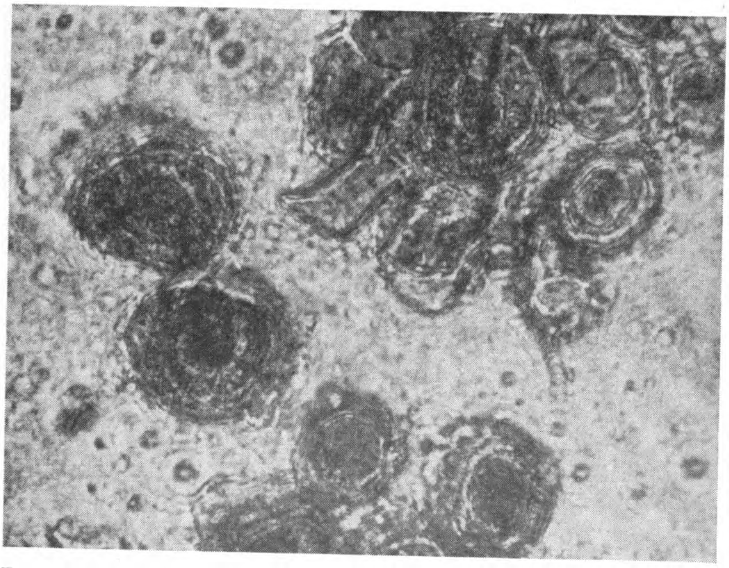

Fig. VI. ×500

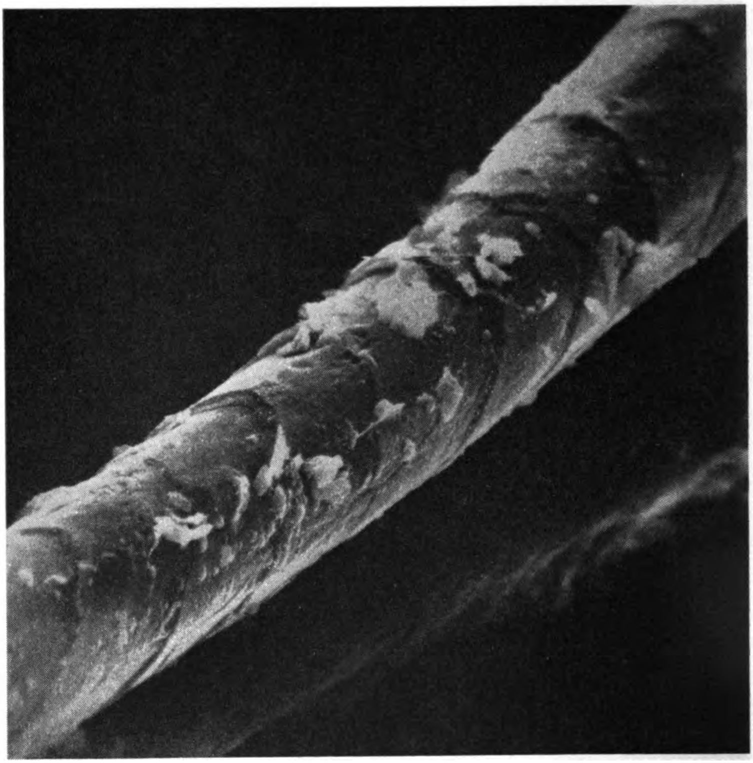

Fig. VII. × 2200

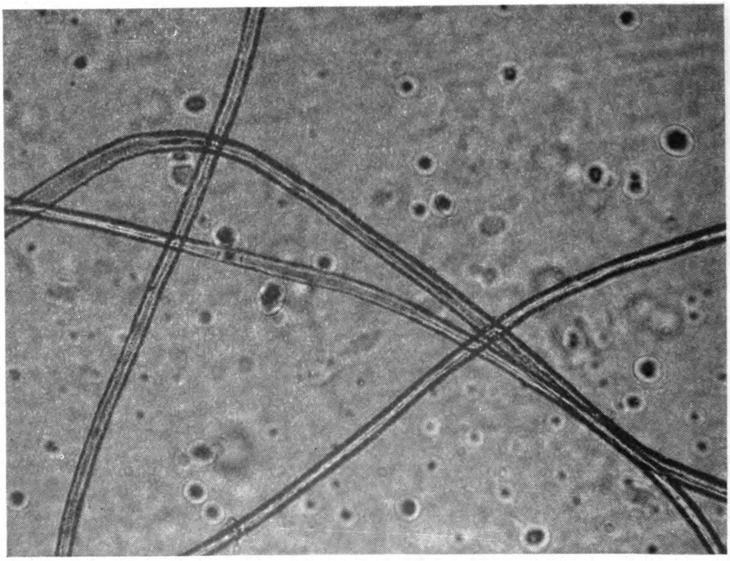

Fig. VIII. × 125

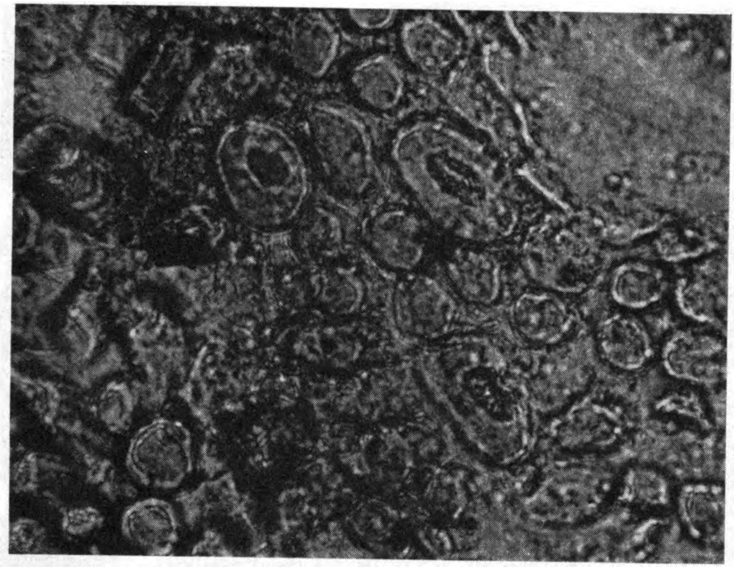

Fig. IX. × 500

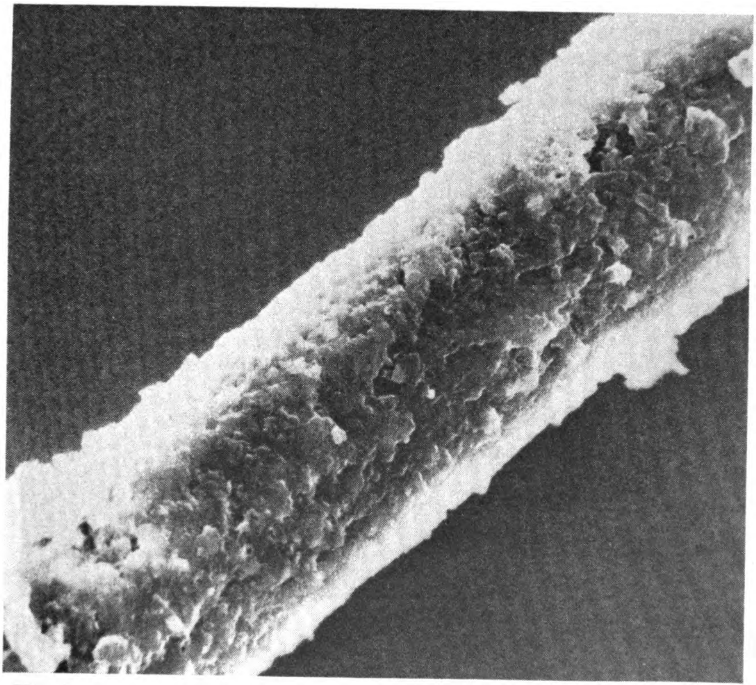

Fig. X. × 2400

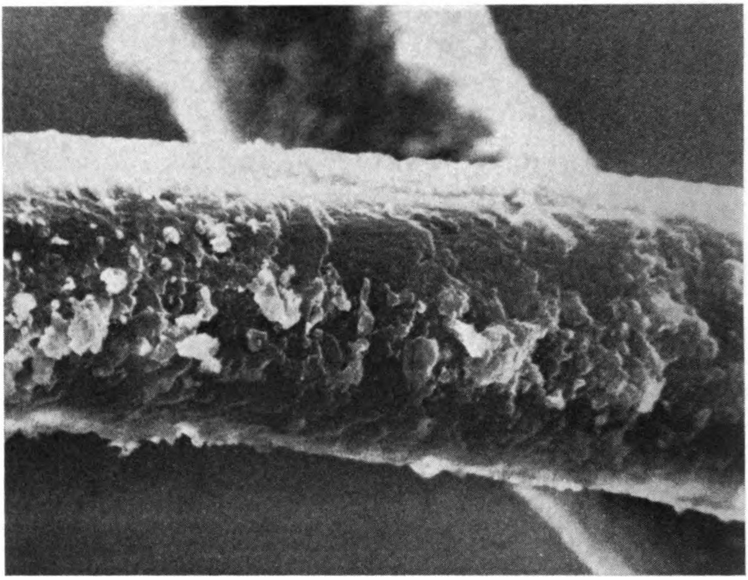

Fig. XI. × 2400

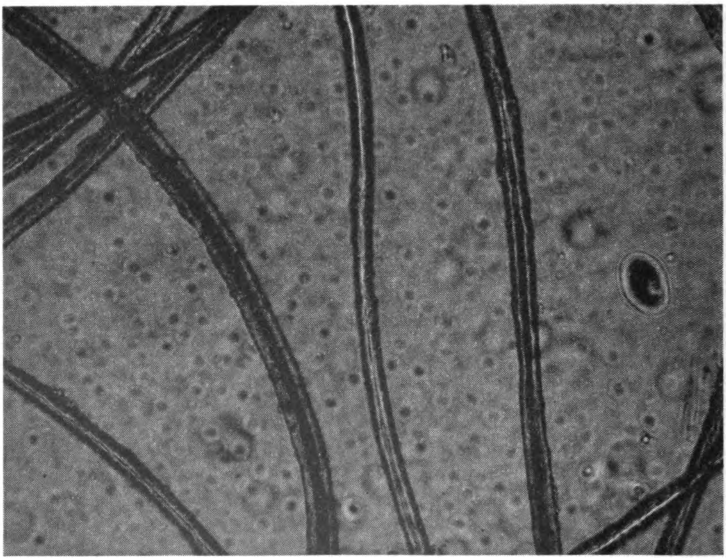

Fig. XII. × 125

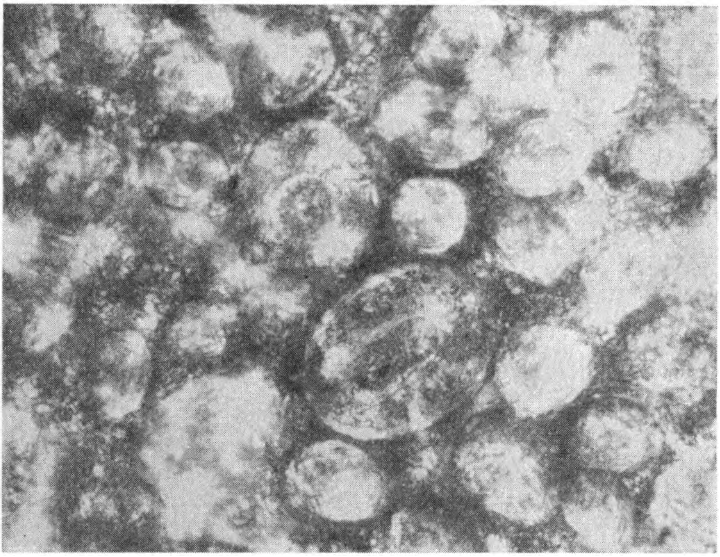

Fig. XIII. × 500

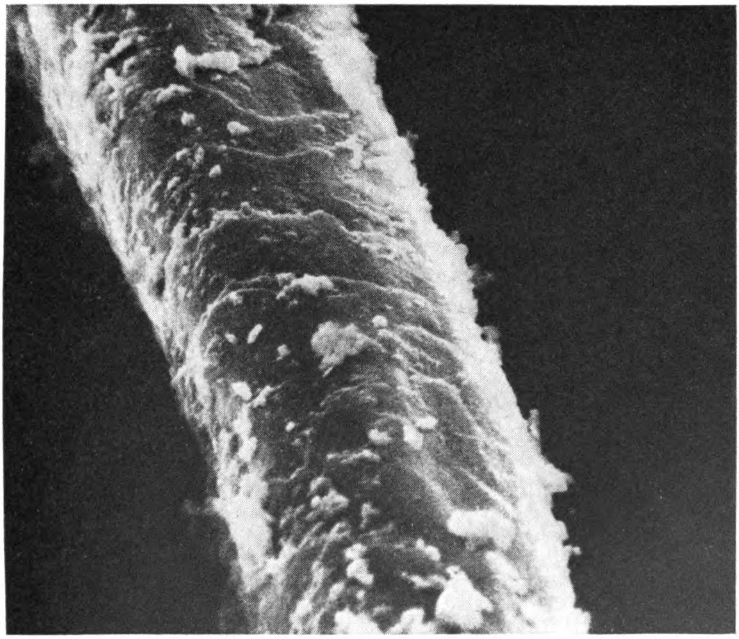

Fig. XIV. × 2200

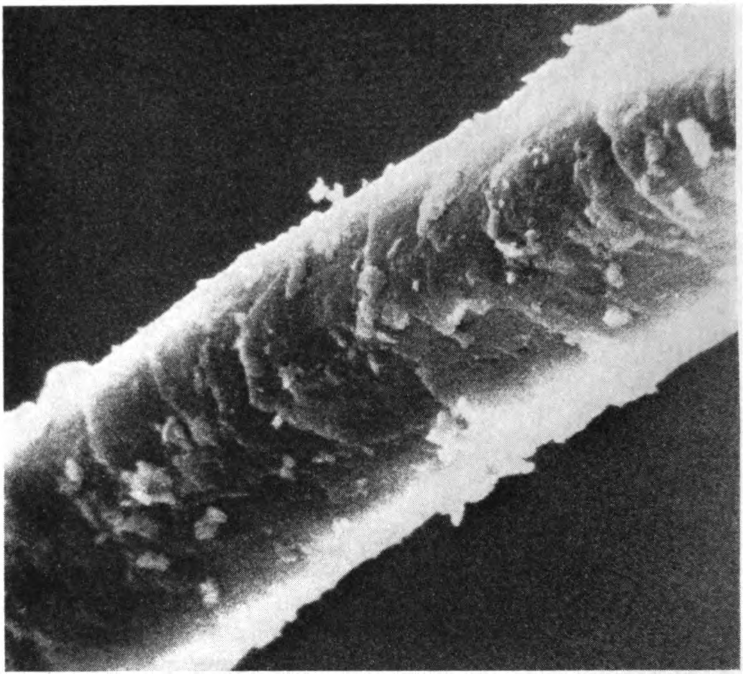

Fig. XV. ×2200

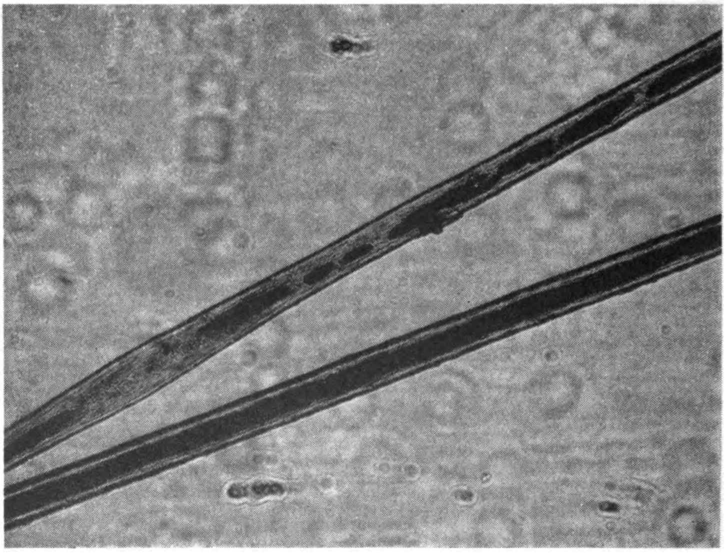

Fig. XVI. ×125

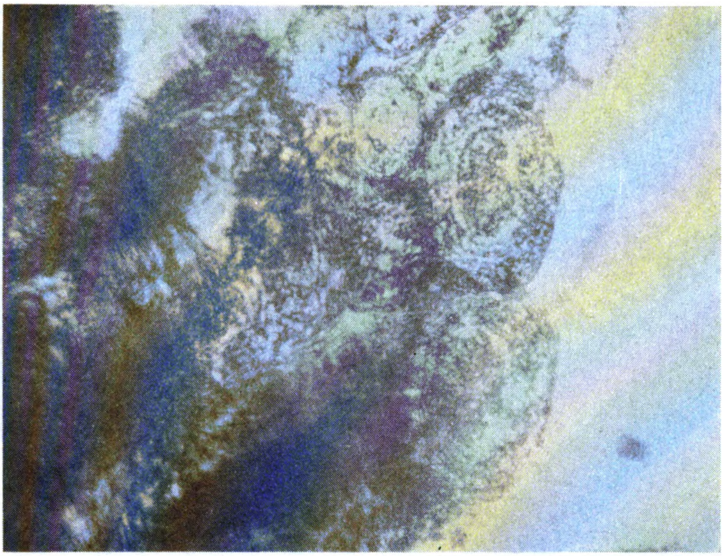

Fig. XVII. ×500

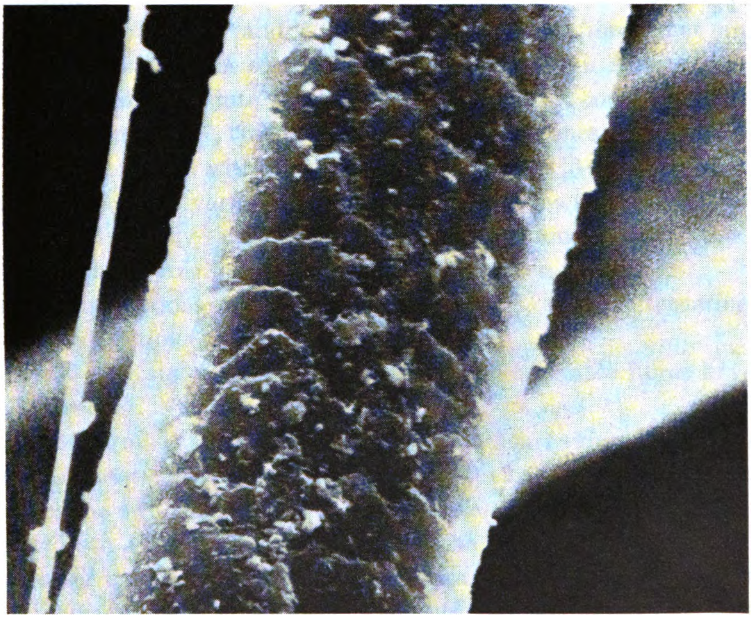

Fig. XVIII. ×2000

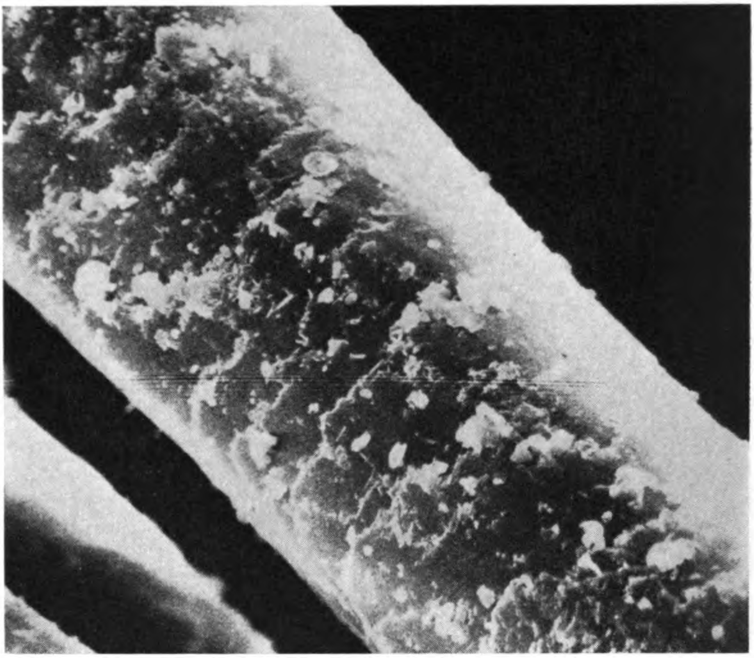

Fig. XIX. ×2100

REPORT ON EXAMINATIONS OF SEVEN YARN SAMPLES FROM A BOLIVIAN ARCHAEOLOGICAL COLLECTION

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Swedish Institute for Textile Research (TEFO), Gothenburg, Sweden

The samples refer to the Gothenburg Ethnographic Museum's collection numbers *70.19.*4, 5, 7, 26, 27, 56, and 54, from a tomb in Niño Korin, Department of La Paz, Bolivia.

The examinations were done primarily in order to determine whether the textile fibres in the samples were of animal or vegetable origins. In addition to that, the dying was looked upon in 70.19.56 and the yarn twist in 70.19.54. Fibres from each sample have been studied in a light microscope.

The samples 70.19.4 and 5 consist of vegetable fibres that are very likely to originate from some kind of bast (figs. 1–4). After comparisons with flax, hemp and jute these kinds of bast fibres could be eliminated.

The fibres in 70.19.7, 26 and 27 are also vegetable ones. Their appearances correspond very well with that of cotton fibres (figs. 5–8).

When studying a yarn that was removed from the fabric in 70.19.56 one can see that the dye uptake is less in the junction points of the yarns, indicating that dying has taken place on the woven fabric.

Similar indications can be observed in fig. 9, where alternating dyed and undyed sections appear along single fibres.

70.19.56 consists of animal fibres. Traces of vegetable fibres have been found, however.

70.19.54 is made up of two single yarns, each having a Z-twist. They have been twisted together S-wise to form 70.19.54.

Out of the two single yarns in this sample, one is darker and the other lighter. Both the yarns contain coarser as well as finer animal fibres. The coarser ones are exactly like the fibres in 70.19.8.*a* (see Hjalmarsson and Liljemark, *Textile fibres*, etc., in this volume, fig. XVI), why they are likely to originate from alpaca.

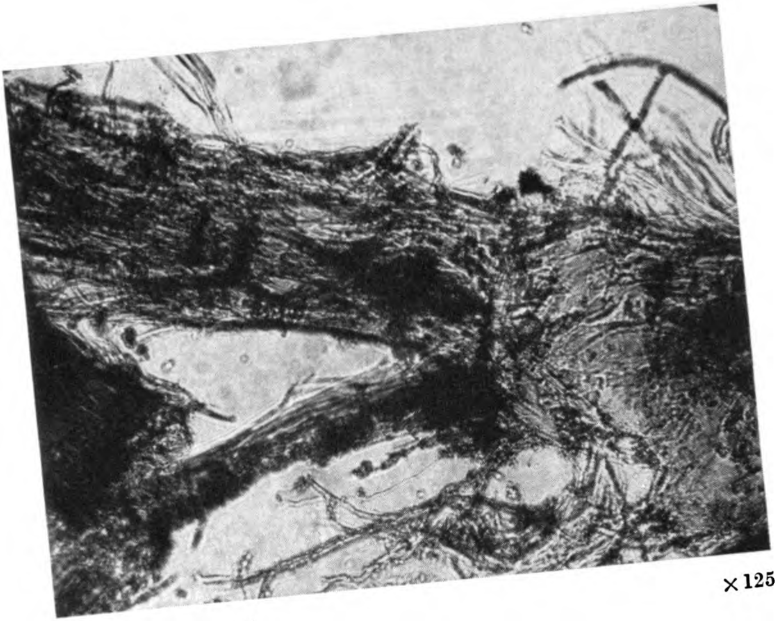

Fig. 1. GEM 70.19.4.

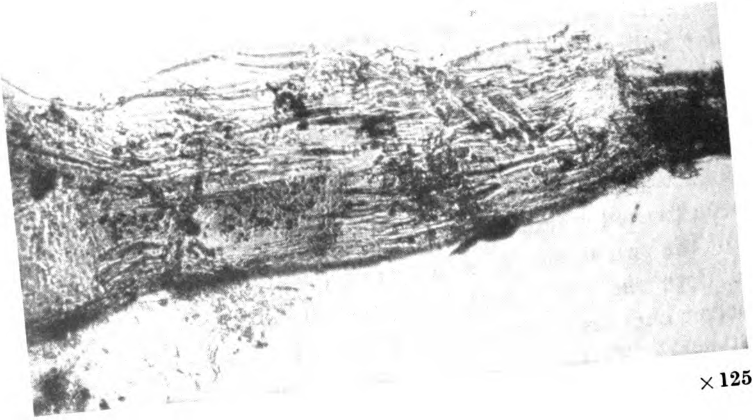

Fig. 2. GEM 70.19.4.

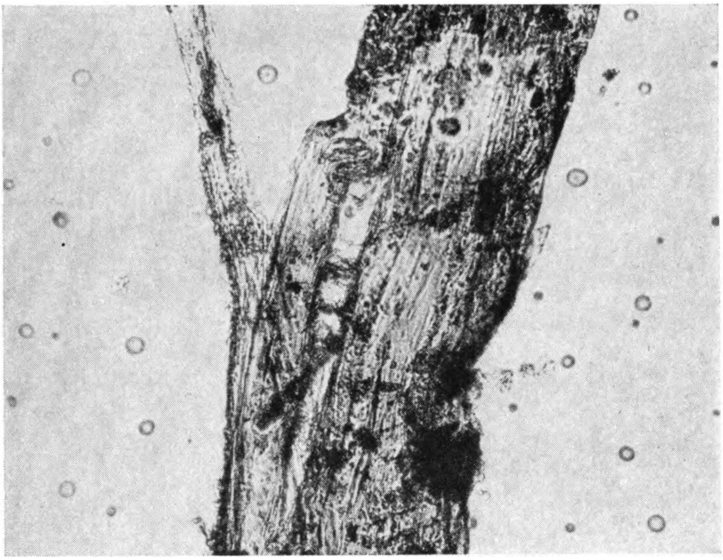

Fig. 3. GEM. 70.19.5. × 125

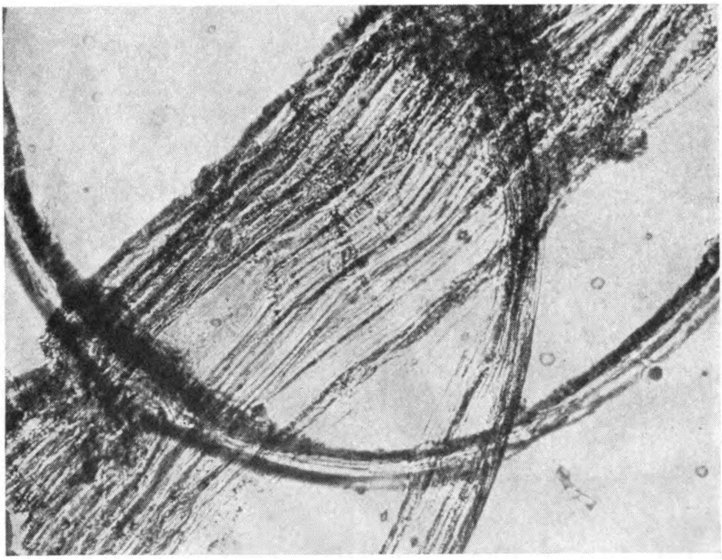

Fig. 4. GEM. 70.19.5. × 125

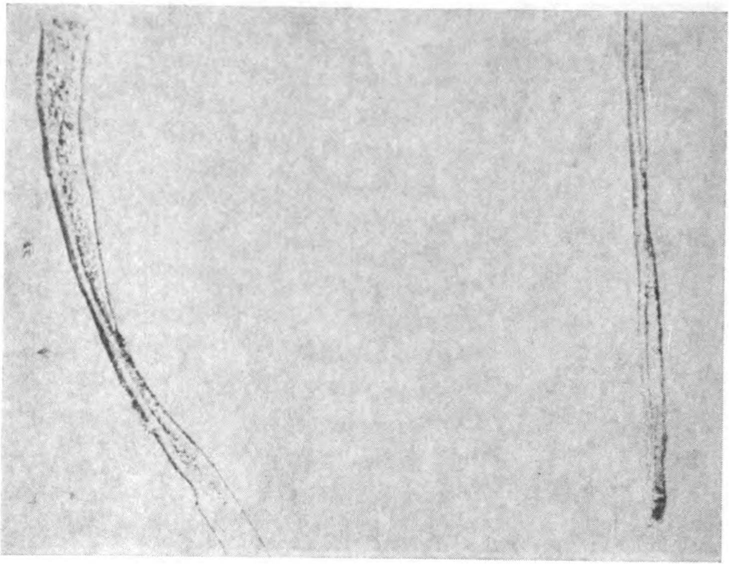

Fig. 5. GEM. 70.19.7. × **125**

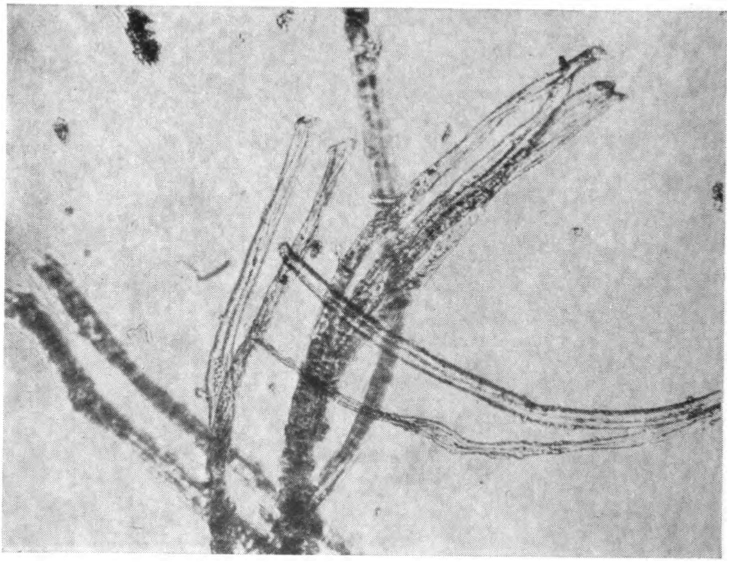

Fig. 6. GEM. 70.19.7. × **125**

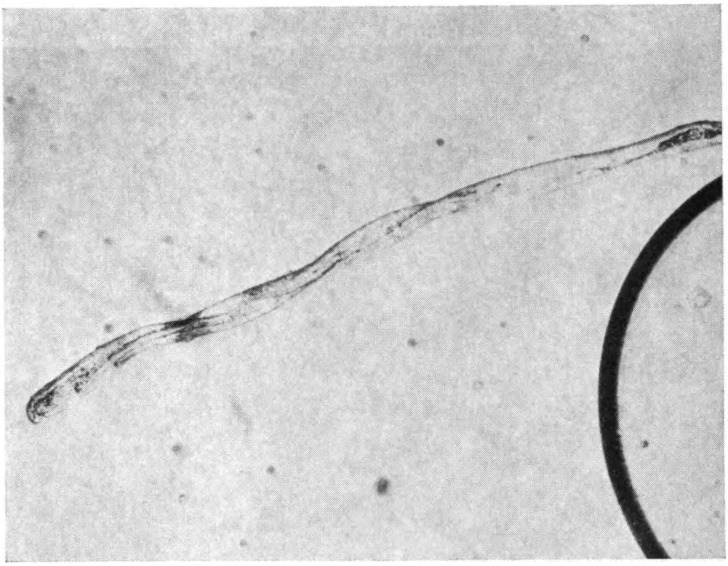

Fig. 7. GEM. 70.19.26. ×125

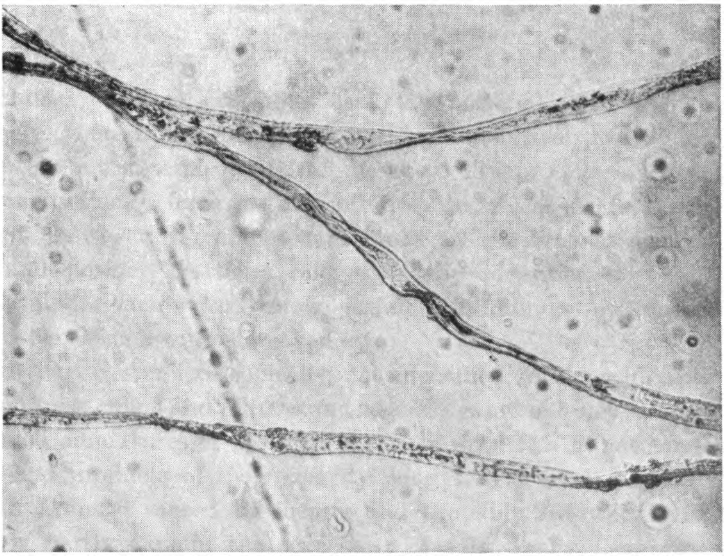

Fig. 8. GEM. 70.19.27. ×125

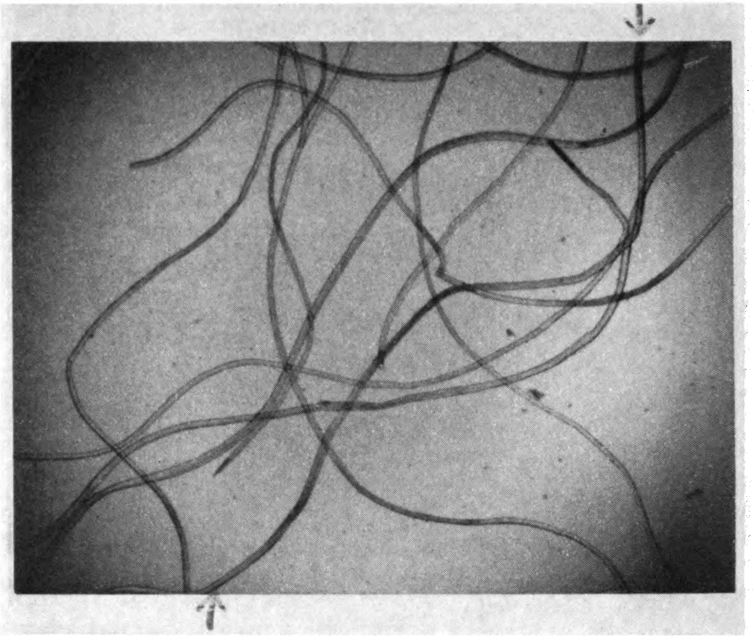

Fig. 9. GEM. 70.19.56. ×40

TOBACCO FROM A TIAHUANACOID CULTURE PERIOD

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Among the recent finds in the tomb of a medicine-man from a Tiahuanacoid culture in the highlands of Bolivia there was a skin pouch (Gothenburg Ethnographic Museum, Coll. No. 70.19.9a), containing powder and small splinters of apparently vegetable origin. The great interest linked to the nature of this tomb material made it important to try a botanical identification of the fragments (Coll. 70.19.9b).

MACROMORPHOLOGY

A detailed examination shows that the material consists mainly of herbaceous stem fragments. There are some relatively well preserved, transversely cut stem pieces, flattened, up to 18 mm long and 2 to 5 mm wide, longitudinally furrowed and often showing leaf- and branch-scars. The bulk, however, is composed of more or less broken, smaller stem pieces and powder. Particles microscopically identified as leaf-, seed- and capsule-fragments (see below) are few in number and mostly not recognizable as such with the naked eye.

Sparse particles, microscopically not identified, or identified as fragments of grass culms and glumes and of moss gametophytes, are probably unintended admixtures of the kind regularly met with in gathered herbs. Insects and products of their activity constitute a small portion of the material. Damage caused by insects and probably by other animals as well may partly explain the scantiness of soft tissues (leaf mesophyll, endosperm, embryo etc.) in the material.

MICROMORPHOLOGY

Methods

The material was soaked in hot water and kept ready for sectioning in a 4 per cent solution of formaldehyde in water. Hand sections were prepared and boiled in chloral hydrate solution (100 g chloral hydrate dissolved in 40 ml of water) and finally mounted in glycerol.

Stem fragments

The stem fragments have an epidermis, bearing numerous remnants of trichomes and occasionally one or more complete specimens of trichomes. The vascular cylinder shows a secondary structure, characterized by bicollateral arrangement of a continuous xylem cylinder between an external and an internal leptome, each accompanied by strands of fibers.

The epidermis shows a distinct longitudinal cuticular striation, proceeding a short way up the basal part of the trichomes, which otherwise have a smooth cuticle. Stomata appear to be of the anisocytic type and are mostly longitudinally oriented. Two kinds of trichomes were found, both simple and thinwalled: *1.* Conical covering trichomes (Fig. 1 a), about 100 to 500 μ long and up to 80 μ wide at the base, uniseriate, three- to six-celled, bluntly pointed. *2.* Glandular trichomes (Fig. 1 b), about 500 to 600 μ long with a uniseriate, three- to six-celled stalk, up to 90 μ wide at the base, and with an enlarged, multicellular, uni- to biseriate glandular head. In some of the trichomes very minute crystalline bodies were observed; these were interpreted as calcium oxalate crystals, though no characteristic forms were seen.

In slender stem parts the cortex consists of a collenchyma of the angular type with intercellular spaces, while in thicker parts there is a modified, more thinwalled collenchymateous parenchyma. Crystal-sand idioblasts occasionally occur in the cortex, measuring about 50 μ in width and 100 μ in the longitudinal direction of the axis.

In the external leptome crystal-sand idioblasts occur more regularly and in a bigger number; they are usually relatively thin and very extended longitudinally, i.e. about 20 μ wide and 400 μ long. In the internal leptome they are similar but few in number.

In the secondary xylem bordered pitted vessels, measuring about 35 μ radially and 40 μ tangentially, form radial multiples of up to six vessels. The axial wood parenchyma is diffuse. The rays are uniseriate or occasionally biseriate, the individual cells are upright, their height being 60 to 300 μ, their average width radially 30 μ, tangentially 20 μ.

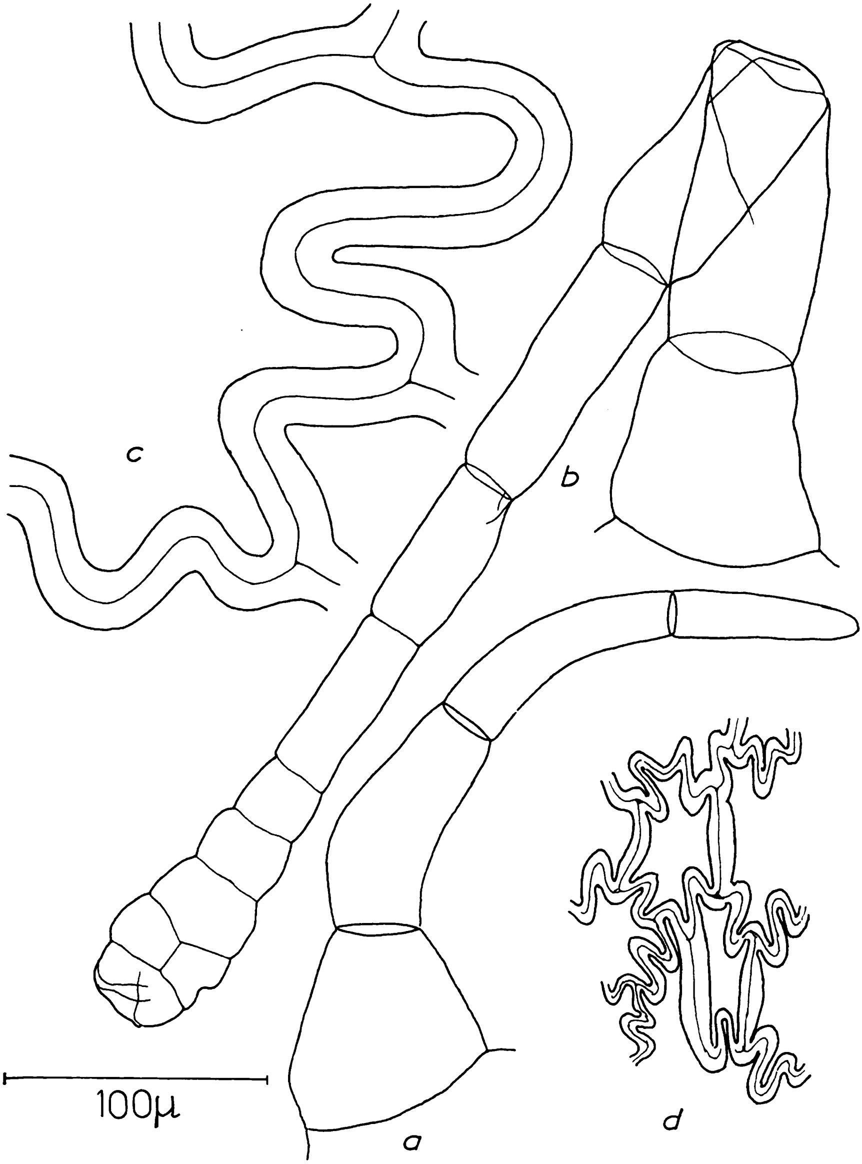

Figure 1: a. Covering trichome; b. Glandular trichome; c. Seed coat epidermis, lateral walls; d. Innermost layer of endocarp.

Leaf fragments

The leaf fragments are few in number, brownish to dark brown, without exception very small.

The epidermis consists of tabular cells having a striated cuticle and slightly sinuous anticlinal walls. The stomata appear to be of the anisocytic type; they are slightly elevated and oriented in different directions; the guard-cell pairs measure about 35 μ in length and 20 μ in width, the circumference being elliptic. On both leaf surfaces there are rounded, up to 70 μ wide scars and some meagre remnants of trichomes, indicating a previous presence of a large number of thin-walled trichomes.

The mesophyll has a single layer of palisade, the anticlinal walls of which are transversely irregularly plicated, obviously due to compression. In the spongy parenchyma are scattered crystal-sand idioblasts, which are round to oblong, 25 to *35* to 65 μ in diameter. There were in one fragment about 60 such idioblasts per mm^2, but their frequency in the leaf is very variable, some fragments actually being devoid of crystal-sand.

Seed fragments

The seed fragments are pieces of the strongly brown coloured outer epidermis of a seed coat.

The cells are low, about 200 to 330 μ wide, the lateral and inner walls being about 15 to 25 μ thick, the outer walls thin and sunken or, usually, tattered. As seen in tangential view most of the cells are nearly equilateral with markedly sinuous walls (Fig. 1c), but in some fragments there are also seen narrower, longish cells, about 30 to 70 μ wide and only faintly sinuous-walled, belonging to the vicinity of the hilum, radiating from there.

Capsule fragments

The capsule fragments are pieces of a pericarp, which is about 100 μ, at the ridges up to 180 μ thick.

The epidermis of the outer side (exocarp) shows longitudinal cuticular striation; the cells are in tangential view tetra- to hexagonal, about 50 μ wide and 90 μ long, arranged longitudinally in rows and elongated in the same direction; they are flattened and have white, 5 to 15 μ thick outer walls and outer parts of the anticlinal walls, which taper inwards; the lumen is filled with a brown mass.

The ground tissue (mesocarp) is composed of a somewhat compressed parenchyma with moderately thickened walls; an occasional cell is filled with crystal-sand.

An endocarp is formed by the inner epidermis and usually one hypodermal sclereidal layer; in the ridges there are about five such layers. The hypodermal sclereids are about 25 μ high and up to 70 μ wide; they have yellow, 7 to 10 μ thick walls, the periclinal walls being pitted, the anticlinal walls strongly sinuous. Some of these sclereids project outwards in the mesocarp as rounded papillae, about 25 to 30 μ high, 15 to 25 μ wide with about 7 μ thick, unpitted walls, showing very fine stratification. The inner epidermis cells are about 16 μ high and as wide as the hypodermal sclereids; the walls are about 3 to 10 μ thick, the inner periclinal walls being pitted, the anticlinal walls strongly sinuous. In tangential view they exhibit a peculiar tortuous pattern (Fig. 1d), that is very characteristic, especially when seen against the background formed by the hypodermal sclereids with their papillose extensions, appearing in the optical cross-section as pairs of concentric circles.

CONCLUSIONS

The stem fragments, which constitute by far the biggest part of the material, show a number of anatomical characteristics, which taken together indicate a solanaceous origin, e.g. the internal phloem, some features of the secondary wood (radial multiples of small vessels, uniseriate rays of upright cells), the crystal-sand idioblasts and the trichomes, especially the relatively specific glandular trichomes present. The same origin is indicated for the leaf- and seed-fragments. Leaving out of account the scanty foreign matter, that was in the foregoing judged as "unintended admixtures" and considering, that there are no other vegetable constituents proper to the material than the stem-, leaf-, seed- and capsule-fragments described, it seems reasonable to assume the same botanical origin for all these constituents.

Thus, accepting, that the stem fragments come from the same plant as the leaf fragments with their distinctive crystal-sand idioblasts in the spongy parenchyma and without other crystal forms, this combination points to *Nicotiana*. The seed fragments are consistent with the seed coat epidermis of *Nicotiana rustica L.* and some other *Nicotiana* species examined in this respect.

The structures so far discussed correspond to descriptions by others concerning *Nicotiana* (Esau, 1938; Goodspeed 1954; Metcalfe & Chalk 1950;

Netolitzky, 1911, 1926), but I have seen no publication on the anatomical structure of the pericarp in *Nicotiana*. However, a comparative examination undertaken on recent material proved, that the pericarp anatomy of *Nicotiana rustica* and some other *Nicotiana* species is essentially in accord with the characteristics of the capsule fragments, found in the tomb material.

From the above statements it is concluded, that the tomb material consists mainly of stem parts of *Nicotiana* and that it contains furthermore very small quantities of leaf-, seed- and capsule-parts of *Nicotiana*.

It remains to determine the species of *Nicotiana*, that can be accepted as the botanical source of the tomb material.

Referring to the information given by Goodspeed (1954) on trichome features in *Nicotiana* species and using his table 8 ("Types and surface distribution of trichomes in the sixty species of *Nicotiana*", op.cit., p. 132–134), 57 species can be excluded, because their stem surfaces do not bear both types of trichomes found in the tomb material.

The three species, which do bear on their stem surfaces both trichome types of the tomb material, are *Nicotiana forgetiana* Hort. ex Hemsley, *N. sylvestris* Spegaz. & Comes and *N. rustica* L.

N. forgetiana is "known only from Flores da Cunha, near Caxias in northeastern Rio Grande do Sul, Brazil," (Goodspeed, 1954, p. 397). Unfortunately I had no material of this species available for micromorphological examination.

N. sylvestris, a native of Argentina, can be excluded, since two herbarium specimens of this species, both grown from seed (1. Adelante. The Garden of A. & A. Blake, Berkeley, California. N. F. Bracelin 1336.—Göteborgs Universitets Botaniska Museum, Göteborg. 2. Uppsala, seed from Daehnfeldt, O. Hedberg 20.9.1943.—Universitetets Botaniska Museum, Uppsala.) show details in their stem trichome structures, which are not in accord with those of the tomb material. The stem trichomes of *N. sylvestris* are, compared with those of the tomb material, somewhat more thickwalled, straighter and stiffer; the covering trichomes are one- to four-celled, prevailingly two-celled, smaller, their individual cells being shorter; the covering trichomes and especially the stalks of the glandular trichomes show a pronounced cuticular striation.

N. rustica is a "highly polymorphic species, long a cultigen and apparently unknown today in the wild state with the possible exception of a single variety below described . . . Of the many more or less distinct races known today . . . two represent horticultural variants while the third, var. *pavonii*, is more significant in that although largely ruderal in habitat, it gives the impression when seen in the field of being a native element of the vegetation in portions of the Bolivian, Peruvian and Ecuadorian highlands." (Goodspeed, 1954, p. 353).

The micromorphological description given in this paper is in many ways applicable to *N. rustica* (garden specimens studied for comparison). In the herbarium material examined one specimen of *N. rustica* came out as most like the tomb material though there was no complete consistency. Nevertheless I am inclined to assume, that a race of *Nicotiana rustica* L. was the kind of plant, from which the tomb material once was gathered.

It must be questioned, however, if the kind of plant, from which the tomb material was gathered, actually can be found among the now living races of *Nicotiana* species. Goodspeed in his monography on the genus *Nicotiana* gives an ample and penetrative account on origins, relationships and evolution of its species. In illustration of the doubts expressed above I cite from this work (Goodspeed 1954, p. 375) the following words, which also touch problems, now actualized through the finding of plant parts of *Nicotiana* in a Tiahuanacoid tomb: "Presumably *N. tabacum* was in pre-Columbian use, doubtless often in cultivation, in the West Indies, much of Mexico, Central America, Colombia, Venezuela, the Guianas and Brazil. Spinden (l.c.) apparently would extend this range to Peru, Bolivia, Chile and Argentina since tubes "for taking snuff, presumably of tobacco, occur far and wide" in those areas "on the classical level of Tiahuanaco." There is, however, considerable doubt that the material snuffed in the tubes so familiar in remains of certain ancient civilizations in the Americas was "tobacco" obtained either from early races of *N. tabacum* or from progenitors of the species of *Nicotiana* which today are native in the regions concerned. In other words, there is little evidence that *N. tabacum* was in pre-Columbian use in western North America or in lower South America."

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THE ACCURACY OF THE RADIOCARBON DATING

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Systematic and random errors in radiocarbon dating have decreased substantially during the last decade as a consequence of improved purification of samples from contaminations, advanced apparatus technology, establishment of a long tree-ring chronology, and investigations on differential carbon isotope assimilation. The achievements of the various radiocarbon dating laboratories have been impressive.

Several international conferences on radiocarbon dating have been of importance not only for the exchange of stimulating ideas but also for the presentation and discussion of some archaeologists' observations of discrepancies between the radiocarbon age and the age established otherwise regarding many objects of vegetable or animal origin.[1-3]

TIME VARIATIONS IN ^{14}C PRODUCTION OVER THE MILLENNIA

One example of such controversies which have been largely reconciled concerns the age of various samples from ancient Egypt, for which the age determined from radiocarbon measurements could appear almost a thousand years less than the age determined from historical counting. The differences between the historical age and the age calculated from radiocarbon determinations were largely explained when measurements of the radioactivity remaining in tree-ring dated old wood[4] indicated that the concentration of the radiocarbon isotope ^{14}C in the air had not been constant during the last seven thousand years for which measurements are available. It was tacitly assumed earlier that the formation rate of ^{14}C was stable.[5,6]

Consequently, if we want to assay the true age of an object, it is not sufficient to measure the amount of radioactivity remaining now, and to calculate the apparent radiocarbon age, assuming that the same relative amount of the radioactive isotope ^{14}C is always originally taken up. Rather, we need in addition some kind of estimate of the relative amount of radiocarbon present in the atmosphere when the plant or animal in question lived.

DIFFERENCES BETWEEN LABORATORIES

An example of another kind of discrepancy between age, estimated from radiocarbon determination, and true age, was brought up by Rowe who found two different time scales for Peruvian archaeological objects.[7] According to one time scale, pottery was introduced on the Peruvian coast somewhere between 1200 and 1450 B.C., but according to the other time scale this happened earlier than 1900 B.C. The standard deviation for a determination was about 100 years, but the difference between the two series of age determinations was about 700 years. Thus, the two time scales appeared to be irreconcilable. However, the differences can now be understood, as will be explained in the following introductory example.

Three different laboratories have published results from the determination of radiocarbon age of tree-ring dated wood, covering also the period mentioned.[8–11] Calibration curves similar to those in Figure 1 can be calculated from these data. In the time range mentioned for the introduction of pottery on the Peruvian coast, the three calibration curves are about 140 years apart (Appendix 1).

Under such circumstances, if samples which are not known to be of the same age are sent to two laboratories, and the answers are 700 years apart, one would not be justified to conclude that the samples are of significantly different age, although one may guess that a sufficiently high level of significance for such a conclusion may be reached if some additional age determinations are done (Appendix 2). However, if only a few samples were available, and if the accuracy within laboratories (*i.e.*, disregarding the differences between laboratories, times, etc.) were only slightly less than it is now in most instances, the results would probably not differ from the 10% significance point, and one would not feel encouraged from a statistical point of view to suspect that the samples were of different age.

Consequently, if the calibration curves mentioned are applied to Rowe's two quotations of the time for the introduction of pottery on the Peruvian

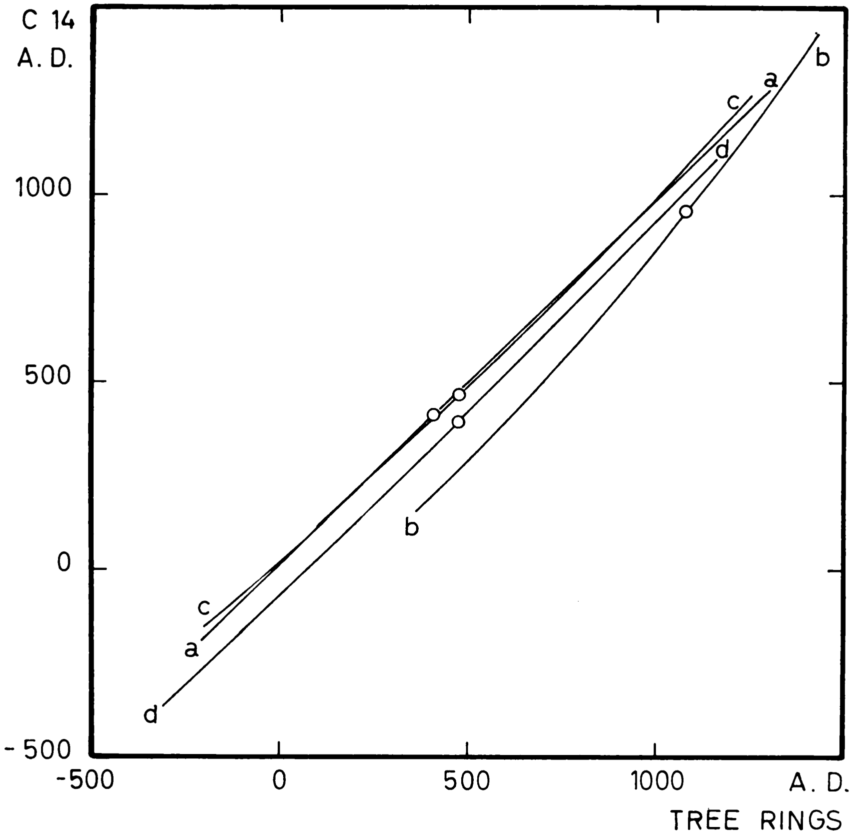

Fig. 1. **Standard curves for the determination of true age from radiocarbon age,[40] calculated from analyses of tree-ring dated wood at four laboratories: a in Tucson,[10] b in Groeningen,[41] c in Philadelphia,[11] and d in San Diego[8] (Appendix 5). The publications used for the calculations include the year "0",[4a, 8b, 16a] and this imaginary year is therefore included in this Figure and the corresponding calculations, however, under protest that chronologers admit no year zero between 1 B.C. and A.D. 1.[42] Drawing by the author.**

coast, 1200–1450 B.C., and before 1900 B.C., one would conclude that the introduction occurred about 2100 B.C.; the 95% confidence interval would be about ±500 years.

Radiocarbon age is calculated from the number of disintegrations of the carbon isotope ^{14}C counted during a time interval of suitable length. The standard deviation of the number of counts equals the square root of the number of disintegrations actually counted, and this square root is used for the calculation of the standard deviation of the radiocarbon age determination.

However, it is well-known from official analytical laboratories that collaborative investigations on accuracy of analyses may reveal significant influences from such sources of variation as differences between seemingly equivalent procedures, differences between occasions (different year or month or week when the analyses are done), differences between analysts, and other differences between laboratories.

It is obvious that the information about standard deviation supplied by laboratories for radiocarbon dating represents a minimum, valid only for ideal conditions which the laboratories seek to attain but which no laboratory can reach entirely. The incompleteness of the information supplied about the accuracy of a radiocarbon age determination can be misleading if it is not properly understood and can then cause confusion and distrust.

So seldom are two measurements of the same sample published that one has the impression that most laboratories are not aware of the possibility of calculating the overall random accuracy within a laboratory from pairs of analyses.[12a,12b] Such measurements must be done independently on two samples of the object whose age shall be determined; mere use of two counters is not sufficient. One collaborative work was actually done as early as in 1960 by Willis, Tauber, and Münnich,[13] however, without the statistical planning and evaluation which is a matter of routine between official analytical laboratories.

It may be mentioned for comparison that even such seemingly simple analyses as moisture determinations in an industrial process have appeared so doubtful that a statistically planned investigation was needed, as has been described in a manual of laboratory procedures.[43] How much more are statistical methods needed for evaluation of the actual accuracy of radiocarbon age determinations!

The short calibration curves just mentioned, and those presented in Figure 1, are not the first ones which demonstrate that results from various laboratories differ. Neustupný,[14] in an article on the accuracy of radiocarbon dating, read at the Twelfth Nobel Symposium in 1969, discussed several such observations and expressly pointed out that "the measurements of the tree-rings performed in Tucson deviate systematically from those carried out in San Diego and Pennsylvania".

Earlier calibration curves have been published, by Suess[8,9] and by Stuiver and Suess.[15] These calibration curves have many wriggles with a time period about 100 years. At the Twelfth Nobel Symposium Suess presented extensive calibration curves.[16,16a] The ensuing discussion is of great interest. Suess stated that "in addition to the statistical error there is probably also a systematic error that may be different for different laboratories". Damon[16b] mentioned that he had plotted both Suess' results and his own results, and that he had found a difference of 180 years between the results from the two laboratories (Appendix 3).[16c] Ralph,[16b] from a corresponding plotting, had also found that a difference exists between the results of Suess' laboratory and his, and Ralph also distrusted the way in which Suess had drawn wriggles in his calibration curve, and mentioned two time periods, about A.D. 1200 and about 4200 B.C., in which the results from his laboratory were contradictory to Suess' results as to the direction of the wriggles.

Vogel expressly refuted Suess' calibration curve, pointing out that "much less than one-third of the points lie further than 1 σ away from the line, which implies that some of the small wriggles—I am not talking about the large ones—are probably not real". (Appendix 4)[16c]

Analyst changes which Suess mentioned as occurring in his laboratory, *i.e.*, "one has technicians and undergraduate students doing the routine preparations"[16b] are a possible source of variation of the kind rather often considered in statistical investigations (variation between analysts and between occasions). However, within Suess' laboratory, the standard deviation of the measurements from a second degree polynomial within the intervals of interest for this article (Appendix 1 and Figure 1) clearly does not give any unfavorable comparison with the work in other laboratories.

Nevertheless, although Suess stated that "it is extremely difficult to recognize these wriggles with certainty,[16b] he drew his calibration curve by "cosmic schwung"[16c] and defended the result as if he were not awere of the great weight of Vogel's critisism: the standard deviation cannot be less than the minimum standard deviation calculated from the radioactivity counting only.

It may be added here that although there is no statistically acceptable proof at present for the existence of the rapid wrigglings with a period of about a century, a main question is whether or not sufficiently sudden changes occur in the production of the isotope ^{14}C, and especially, if an excess or a deficiency disappears sufficiently rapidly as soon as the production of carbon-14 returns to a value which is normal, considering the changes over the millennia. High-altitude cosmic-ray neutron intensity variations and production of radiocarbon have been studied by Soberman.[17] Alleged short-time variations in carbon-14 production have been claimed to show some degree of negative correlation to the variation in sun spot numbers.[18,19] It appears from recent investigations that exchange times for carbon dioxide are sufficiently short for the appearance of wriggles with a period of about a century.[20,21] Consequently, the hypothesis about short-time variations, originally suggested by de Vries[22] may become a challenging project for a statistically planned collaboration between the radiocarbon dating laboratories.

However, the recent publication of Suess' calibration curve in the prestigious journal Scientific American by Renfrew[23] together with the erroneous statement that the carbon-14 determinations at University of Arizona, University of Pennsylvania, and University of California at San Diego in general agree fairly well with one another, makes it necessary to urge those who intend to submit samples for radiocarbon dating to see their statistician.

THE CARBON DIOXIDE CYCLE

Two causes for deviations between the radiocarbon age and the true age of an object have so far been discussed: long range variations in the production of the isotope carbon-14, and variations between the laboratories. These variations can be remedied with properly interspaced calibration experiments for which tree-ring dated wood fortunately is available.[4,16b]

Still another possible complication may be discussed briefly, although the magnitude of its effect is not known very well. As early as in 1952, Wickman found from carbon isotope analyses of 105 herbarium specimens that characteristic differences occur between the relative abundances of carbon isotopes in plants grown in different biotopes.[24] He concluded that these differences are related to the varying intensity of the local carbon dioxide cycle. A similar investigation of 104 species was published in 1971 by Smith and Epstein.[25] They discuss photosyntetic fractionation mechanisms. Neither they, nor Wickman, found any relationship between phylogeny and the specific isotope fractionation. Isotope fractionation studies have also been done on marine animals.[26] Wickman's hypothesis seems supported by investigations on variations in carbon dioxide concentration and carbon isotope relationships in various types of localities, *e.g.*, dense forests and open fields,[27–30] and the hypothesis also seems supported by an investigation of the amount of carbon dioxide generated by the soil.[31]

Consequently, one would hope that research on the influence of the biotope on carbon-13 relationships in plants, and research on carbon-14 concentrations in soil and in carbon dioxide released from soil will increase our information about the influence of the biotope and the local carbon dioxide cycle on the apparent radiocarbon age. This may enable the calculation of correction terms, both for species, and for biotopes.

A few words need to be said about the accuracy of the assay of the stable isotopes also. An inspection of plots of the specific isotope fractionation $\delta^{13}C$ in Sequoia wood[8] and in bristlecone pine wood[9] versus age indicates that even if a few outlying results could be eliminated with statistical methods,[12c, 32, 33] the overall standard deviation is much larger than the accuracy claimed for the measurements. Also in this case, fully duplicate, randomized analyses would have given additional information. Furthermore, the inspection leads to a guess that further research may show significant differences in the specific isotope fractionation for bristlecone pine wood and for Sequoia wood, at least if one uses tree-rings of Sequoia wood which have grown before the tree had reached a height sufficiently above the main carbon dioxide recycling layer.

AGE OF THE BOLIVIAN CAVE BURIAL FIND

A piece of a skull, two samples of *Ilex Guayusa* leaves, and one sample of ground *Ilex Guayusa* leaves, the latter extracted with methanol for the purpose of chemical analysis, and dried, were sent to *Laboratoriet för radioaktiv datering* in Stockholm. The samples were processed according to current methods.[34–37] As is customary in radiocarbon dating, the accuracy of the results was based on the radioactivity counts; however, standard deviations less than 100 years were rounded off to 100. The results from the age determinations were as follows (radiocarbon age and standard deviation): the skull A.D. 755±100, the two leaf samples A.D. 375±100, and 355±200, and the sample of ground, extracted leaves A.D. 1120±100.

The apparatus were recently rebuilt, and a calibration curve is not yet available,. and the number of duplicate determinations now available is not sufficient for accuracy calculations. Consequently, calibration curves calculated from results published from other laboratories have to be used, and differences between laboratories become an additional source of variation. The calibration curves for the time interval of interest were calculated with an electronic desk-top computer which uses recorded programs, by fitting a second degree polynomial.[38] In some cases the radiocarbon age had to be calculated according to an equation published elsewhere[8a] from other data supplied. The calibration curves are shown in Figure 1.

The standard deviation between laboratories for A.D. 500 was calculated from the corresponding regression line points. Values for Student's t distribution to be used with combined standard deviations with different degrees of freedom were calculated according to Cochran and Cox.[39]

In order to get the time to which the skull dates back, we add the correction term obtained from Figure 1, 77 years, to the result from the radiocarbon determination. A combined standard deviation, 141 years, was obtained as the square root of the sum of squares of the standard deviations for variations within and for variations between laboratories. The size of the confidence interval is the product of the standard deviation and the t value. The 95% confidence interval arrived at for the skull is from about A.D. 470 to about A.D. 1190; similarly the 50% confidence interval is from about A.D. 710 to about A.D. 950.

The leaf sample which was ground and extracted with methanol deviates in radiocarbon age significantly from the other leaf samples. It was found in a bag strikingly similar to another bag from which one of the other leaf samples was taken. At present this discrepancy cannot be explained, and the result from this sample is regarded as outlying.

The time to which the other *Ilex Guayusa* leaves date back was obtained by adding the correction term to the weighted mean value of the result from the radiocarbon age determination. The standard deviation for this mean value, 80 years, was combined with the standard deviation for differences between laboratories, and the result, 134 years, used for the calculation of confidence intervals. The 95% confidence interval arrived at for the leaves is from about A.D. 100 to about A.D. 800, and the 50% confidence interval arrived at is from about A.D. 330 to about A.D. 560.

When the laboratory has got its calibration curve ready for the time period of interest here, the confidence intervals can be recalculated and are expected to be considerably less broad than those which can be calculated now. Such calculations are described elsewhere.[40]

Finally, the question remains whether or not the skull and the leaves are contemporary. Because the radiocarbon age of both kinds of objects was determined by the same laboratory, we use the standard deviations stated by the laboratory for the comparison. The age difference is $755-371=384$ years. The standard deviation for the difference[12d] is $(100^2+80^2)^{0.5}=128$ years; $t=3.0$; $P=0.002$, *i.e.*, the probability that the skull and the leaves are contemporary is about 0.2%. However, if the leaves were collected in a forest with a high carbon dioxide recycling, the leaves may date back to a time later than the one calculated here, and if so, the difference in age would be less. With the information at present available, the 5% confidence interval for the age difference is about ±250 years.

APPENDIX

Appendix 1. The calculation of regression line points from published radiocarbon age measurements: range of time, number of measurements included, mean value of the age (A.D.) of tree-ring dated wood, the corresponding estimate of radiocarbon age, variance ratio F for curvilinearity (an asterisk indicates significance at the 5% level), estimate of radiocarbon age for wood from 2100 B.C., standard deviation from quadratic regression.

Philadelphia. 2985 B.C. to 1350 B.C.; $n=41$; $\bar{x}=-2080$; $f(\bar{x})=-1672$; $F=0.5$; $f(-2100)=-1686$; $s_{y\cdot x}=115$.

San Diego. 2500 B.C. to 900 B.C.; $n=42$; $\bar{x}=-1972$; $f(\bar{x})=-1713$; $F=5.8^*$; $f(-2100)=-1912$; $s_{y\cdot x}=70$.

Tucson. 3165 B.C. to 1349 B.C.; $n=20$; $\bar{x}=-2015$; $f(\bar{x})=-1471$; $F=2.9$; $f(-2100)=-1533$; $s_{y\cdot x}=82$.

Appendix 2. Simplified calculation: $d.f.=2$; $s=140$; $s_{\bar{x}_1-\bar{x}_2}=198$; $t=700/198=$ $=3.5$; $0.05<P<0.10$.

Appendix 3. It appears that it did not occur to the discussers that this should be considered a comparison of distance between regression lines, here simplified to distance between mean values. Thus, if the standard deviation for a measurement is 100 years, the standard deviation for the difference between mean values obtained from series of 80 and 240 measurements[16c] is $100 \cdot \sqrt{(80+240)/(80\times 240)}=13$; $t=14$, and the difference 180 years is indeed highly significant. Thus, it is not sufficient, as Vogel has done,[16c] to smooth Suess' line for use as a correction curve in archaeology.

Appendix 4. A calculation of the standard deviation of Suess' experimental points from his calibration curve between A.D. 310 B.C. and A.D. 1160 as measured from his graph[16a] gave 34 years. A comparison with the standard deviation for the measurements, shown in the graph, 38 years, gave $F=38^2/34^2=1.3$, *i.e.*, no significant difference. However, Suess' calibration curve is, by his "cosmic schwung",[16c] drawn at such a distance from the measurement point of wood which grew about A.D. 43 that this has a substantial effect on the standard deviation; and the situation is similar for wood which grew about A.D. 867. If these two points are disregarded because the calibration curve appears to be drawn fancifully here, the standard deviation of the points from the curve corresponds to 29 years, and $F=38^2/29^2=1.7$ ($P=0.01$). This indicates significantly that the calibration curve is not correct.

Appendix 5. For explanation, se Appendix 1. The quadratic regression equation is also given; the point for A.D. 500 is calculated.

a. 206 B.C. to A.D. 1252; $\hat{Y}=11.7+0.9798X-0.0000035X^2$; $n=11$; $\bar{x}=410$; $f(\bar{x})=413$; $F=0.0$; $f(500)=501$; $s_{y \cdot x}=97$.

b. A.D. 359 to A.D. 1436; $\hat{Y}=-166.9+0.7920X+0.000227X^2$; $n=8$; $\bar{x}=1081$; $f(\bar{x})=954$; $F=2.4$; $f(500)=286$; $s_{y \cdot x}=41$.

c. 200 B.C. to A.D. 1200; $\hat{Y}=23.2+0.8907X+0.000082X^2$; $n=39$; $\bar{x}=473$; $f(\bar{x})=463$; $F=2.8$; $f(500)=489$; $s_{y \cdot x}=48$.

d. 310 B.C. to A.D. 1160. $\hat{Y}=-72.4+0.9593X+0.000040X^2$; $n=44$; $\bar{x}=478$; $f(\bar{x})=395$; $F=0.7$; $f(500)=417$; $s_{y \cdot x}=52$.

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